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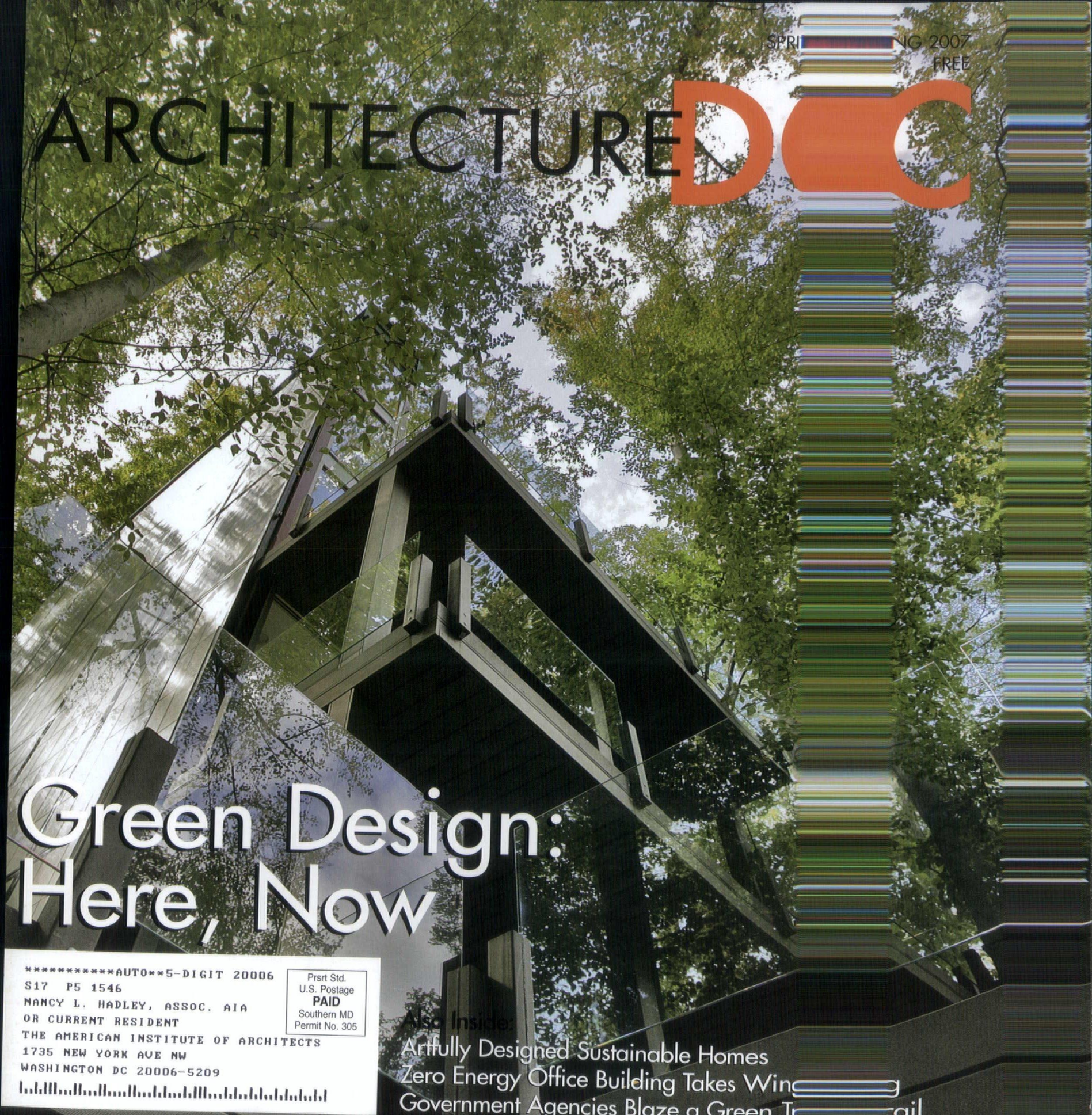

Green Design: Here, Now

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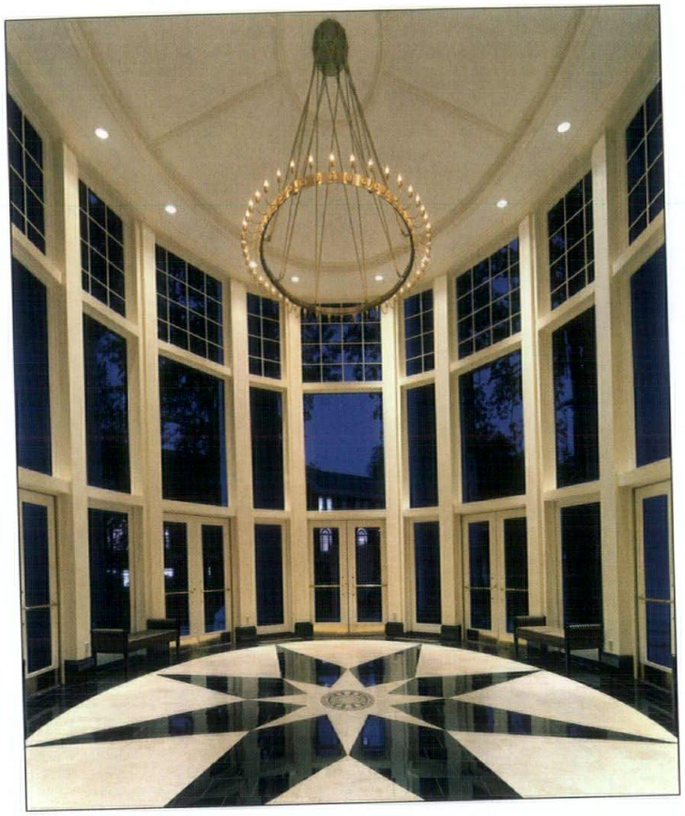

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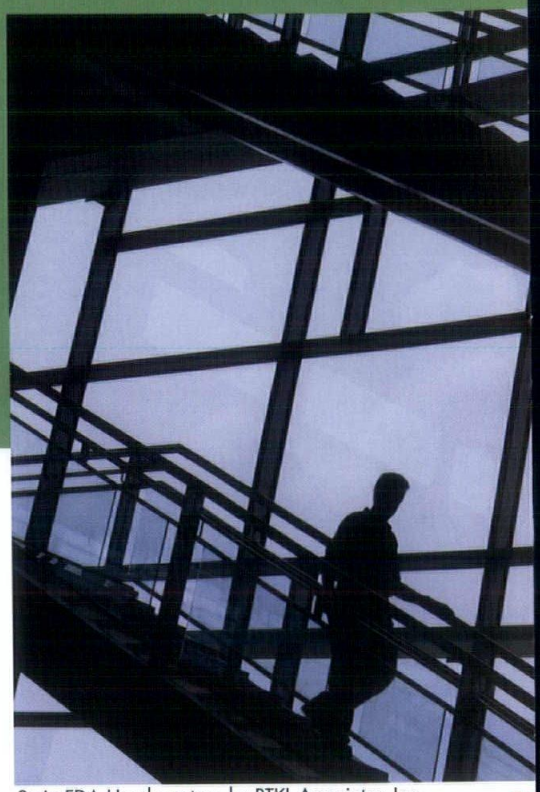

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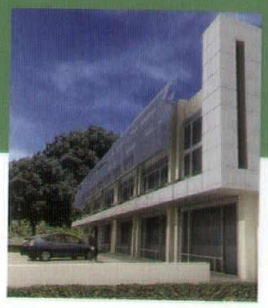

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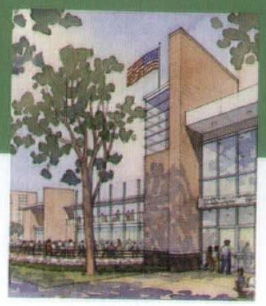

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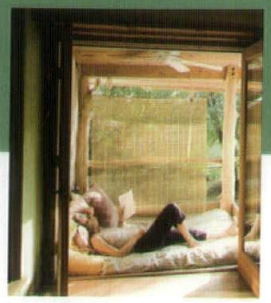

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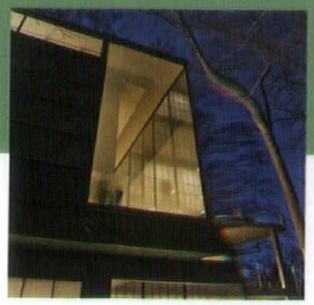

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Mainstreaming Green

David Hamilton

As I write, an international group of climate scientists has just unveiled a major study with ominous projections of global climate change. One bright spot in the report: if we make changes over the next few decades to significantly reduce greenhouse gas emissions, we can mitigate future increases in temperature. Other changes in the way we live could reduce the environmental degradation—water pollution, hazardous waste, and tropical deforestation—that occurs in parallel with global warming. But as individuals, where do we begin? Our built environment—the buildings where we live and work—is a good place to start. That's the focus of this issue of *ARCHITECTURE**DC***.

Transportation and the built environment account for the bulk of our consumption of energy and other natural resources. Buildings require a lot of energy and materials to construct, and consume a lot more energy for heating, cooling, and lighting throughout their useful lives. A growing number of architects practice ***sustainable design,*** methodically implementing new ways to design buildings and plan construction projects to reduce material and energy consumption. Sustainable design strategies range from simple things such as increasing insulation or using wood from sustainably managed forests, to incorporating technologically sophisticated systems that enable buildings to produce their own energy. As you read through these pages, you'll see how a variety of strategies are being applied to DC-area buildings.

Welcome!

In our feature article, **Ron O'Rourke** writes about **Monarc Construction's** new zero-energy headquarters office building, which is being designed by **Studio27 Architecture** to achieve a LEED Platinum rating—the highest rating in the certification system of the U.S. Green Building Council. Ron also covers two recently renovated houses by **Travis Price Architects** that employ simple steps to significantly reduce their energy consumption and achieve other green-design goals.

We also profile **Bruce Mau,** a Canadian designer who mounted a recent major museum exhibition entitled ***Massive Change*** that presented an inspiring and mind-expanding array of ideas for changing the ways we live and work. Mau argues convincingly that design and designers can and should be central to the effort to change the way we live, succinctly expressed in his motto, "It's not about the world of design. It's about the design of the world." Mau will deliver ***Massive Change***—in lecture form—at **DesignDC 2007,** AIA | DC's annual conference. The **July 18** lecture is open to the public; register online at **www.aiadesigndc.org.**

Elsewhere in this issue, editor **Michael Tardif** chronicles the trail-blazing sustainable design efforts of government agencies and local nonprofits, while **Alan Dessoff** visits Community Forklift, an innovative local nonprofit recycling emporium. **L. Catherine Hader** writes about green community centers. **Ellen Tani** shows how artists, architects, and their families are living green. **Hal Bolton** and **Adam Siegel** provide advice for greening your home, while **Denise Liebowitz** highlights sustainable products and where you can buy them.

No longer on the fringes, green design has achieved critical mass and gone mainstream. With this issue we take notice of the trend and its aims, and hope that, in our own small way, we help push it along. We also take our own advice. Beginning with this issue, *ARCHITECTURE**DC*** will be printed in a way designed to reduce paper consumption. Let us know how you like it—we love hearing from our readers. Drop me a line with suggestions or comments at **mfitch@aiadc.com.** And don't forget to sign up for Bruce Mau's lecture—you'll leave with a sense of exhilaration and hope for the future, something we need right now.

Mary Fitch, AICP
Publisher

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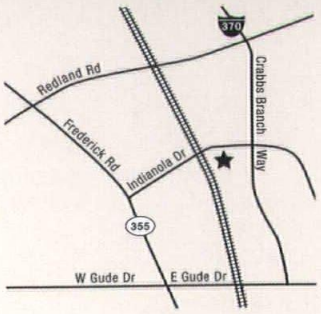

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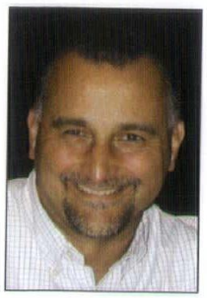
What Does It Mean to be Green?



Green Design: It's here, now. But what does it mean to be green? What is sustainable design, exactly? Some green design strategies—particularly those related to energy conservation—present obvious choices of unequivocal benefit to the environment: more insulation, high-performance insulated windows, paints and coatings low in volatile organic compounds. Other choices are not so clear, requiring that the costs and benefits, the pros and cons, of alternative choices be weighed. For example, the environmental impact of material manufacture and the durability of those materials may be at odds with one another. A lead-coated copper roof has a life span of 50-100 years, but its durability must be considered against the environmental damage of mining copper, the energy consumed to process it, and the environmental effects of lead leaching off the finished roof. In some cases, a lead-coated (or preferably, uncoated) copper roof might be the most environmentally-sound choice. In other cases, another material might be better.

Editor's Note

In this issue, we highlight the sustainable design strategies of DC firms. While it's beyond the scope of this magazine to conduct a detailed analysis of the design choices made for each project, we wanted to highlight the intellectual ferment taking place in DC with respect to sustainable design, and the wide range of strategies and choices that DC firms are making in building a more sustainable world. The green design information and knowledge amassed by the design and construction industry over the last few years is nothing short of impressive, and will continue to grow. We hope that in some small way, we can contribute to that dialogue, and open a small window for you into the world of sustainable design.

Michael Tardif, Assoc. AIA, Hon. SDA
Editor

SCHOLARSHIPS FOR ASPIRING ARCHITECTS

The Washington Chapter/AIA and the Washington Architectural Foundation are proud to announce the fourth annual **Washington Chapter Scholarship,** providing $2,500 to a DC high school graduate studying architecture in an accredited college architecture program. If the student maintains an acceptable grade-point average and remains in the architecture program, he or she will receive $2,500 each subsequent year until graduation.

2007 scholarship applications and all attachments must be postmarked no later than **March 30, 2007.** For more information and to download the application form, visit **www.wafonline.org.**

CONTRIBUTORS

Hal Bolton, AIA, LEED®AP, is the founding principal of the DC architecture firm Terraplane Studios. In his first contribution to *ARCHITECTURE**DC***, ("From the Bosom of Mother Earth") he translates the complex topic of geothermal energy into plain English.

Alan Dessoff ("Don't Demolish and Dispose"), is an independent journalist in Bethesda, Maryland who has written about architecture and design for *ARCHITECTURE**DC*** and other publications including *The Daily Record* and *Construction Today.*

L. Catherine Hader ("New Community Greens"), a stalwart contributor to *ARCHITECTURE**DC***, is vice president and director of marketing for **DMJM Design** in Arlington, Virginia.

Denise Liebowitz ("DetailsDC"), an urban planner formerly with the **National Capital Planning Commission,** is a frequent contributor and guest editor of *ARCHITECTURE**DC*** who has written many feature articles about our city's finest architecture. Denise returns as guest editor for the Summer 2007 issue.

Ronald O'Rourke, a prolific contributor to *ARCHITECTURE**DC***, in this issue covers the first zero energy office building to be designed and built in the DC area ("A Green Building Takes Wing") and two sustainable and modern major residential renovations ("Sustainably Modern").

Adam Siegel, a board member of **The Energy Consensus,** a nonprofit seeking a new dialogue on energy issues, challenges preconceptions of the cost of sustainable design ("Costs and Benefits of Going Green") in his first contribution to *ARCHITECTURE**DC***. He is also a co-author of Energize America, a 20-point plan for a sustainable and prosperous energy future (www.ea2020.org).

Ellen Tani, marketing coordinator for Cunningham | Quill Architects, marks her debut in *ARCHITECTURE**DC*** with a visit to sustainably designed multi-family artists' housing and a remarkably green single family home in Takoma Park.

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July 2006, 11th Arrondissement, Paris.
Jean Nouvel at his studio.

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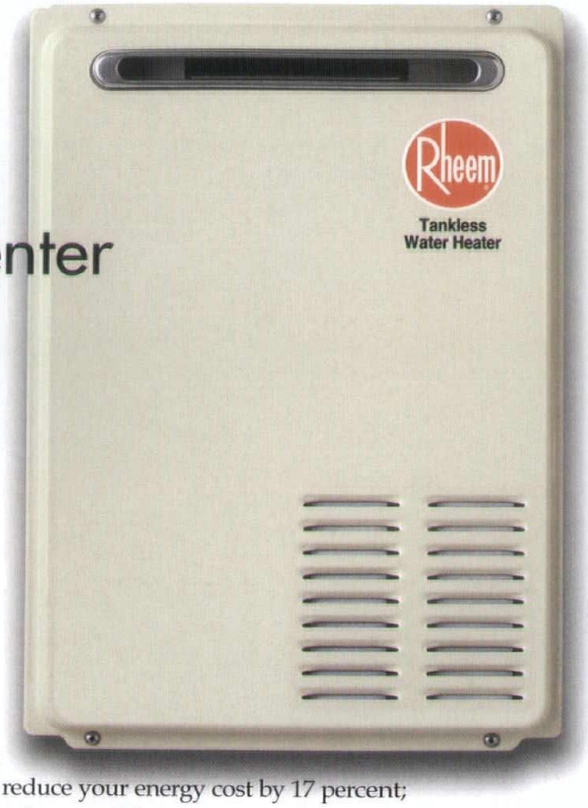
by Denise Liebowitz

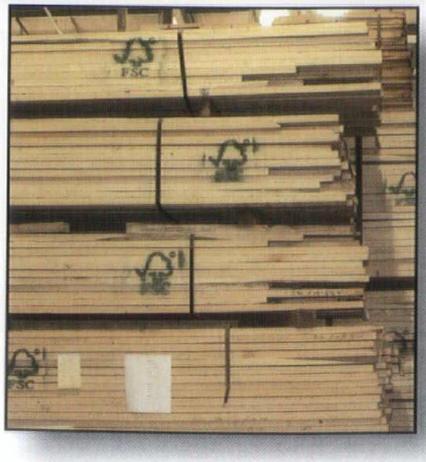


What used to be counterculture niche marketing has become mainstream retailing, and Washington-area homeowners who want to go "green" now have several local sources for eco-conscious building and remodeling materials.

At **Eco-Green Living** (formerly Future Green), owner Keith Ware bills his welcoming Logan Circle shop as "DC's green and fair trade home and living store for lifestyle, personal care, and home remodeling." Tucked among the eco-friendly knitting yarns, hemp clothing, and organic bedding are sustainable building materials and equipment including **Rheem Tankless Water Heaters.** Long popular in Europe, gas-fired tankless water heaters produce hot water on demand. So you always have hot water when you need it, but you don't waste money and energy keeping 40-50 gallons of water hot all the time. If your existing water tank heater is gas-fired, replacing it with a Rheem Tankless Water Heater can reduce your energy cost by 17 percent; if your tank is electric, the savings can be as high as 39 percent. Prices vary by size, but until December 31, 2007, Rheem Tankless Heaters qualify for a tax credit of up to $300. Eco-Green Living is at **1469 Church Street, NW; (202) 234 7110; www.eco-greenliving.com.**

Jason Holstine of the **Amicus Green Building Center** in Kensington, Maryland, is making it easy for environmentally conscious homeowners to "walk the walk." Amicus seeks to be a one-stop resource for green building supplies. One of its most popular products, **Kirei Board,** has many applications. Made from the stalks of the sorghum plant, Kirei Board is a durable substitute for wood that can be used in cabinetry, flooring, wall panels, wainscoting, and counters. Once the sorghum is harvested for food, the stalks, which would otherwise be discarded or burned, are heat pressed with a non-toxic adhesive to form lightweight but strong sheets and panels. In Japanese, "kirei" (Kee-ray) means "clean" and "beautiful." The aptly-named Kirei Board helps preserve trees by making use of a waste material, and reduces environmental damage caused by wood harvesting. Depending on thickness, a 3 x 6-foot sheet costs $165-260. Amicus stocks a wide range of other products, including healthy paints and finishes, counters, LED lighting, and flooring. The store is at **4080A Howard Avenue, Kensington, Maryland; (301) 575-8590; www.amicusgreen.com**

Also in suburban Maryland just across the District line is **Community Forklift,** a unique building supply store based on the premise that one person's trash is another person's treasure (for more about Community Forklift, see the feature article that begins on page 40). Operated by the non-profit **Sustainable Community Initiatives,** Community Forklift sells surplus, salvaged, and green construction materials at affordable prices. It also carries new green products by **Nature Neutral®,** including **UltraTouch™ Cotton Insulation,** and low- or no-VOC paints, stains, and sealants. The store also carries Nature Neutral's selection of **lumber, trusses, plywood, subflooring,** and **roof sheathing** certified by the **Forest Stewardship Council** for having been harvested and manufactured using environmentally and socially responsible methods. Until now, FSC-certified lumber has been relatively hard to find in the DC area. At Community Forklift, you can also donate building materials and receive a tax deduction. Visit them at **4671 Tanglewood Drive, Hyattsville, Maryland; (301) 985-5180, www.communityforklift.com.**



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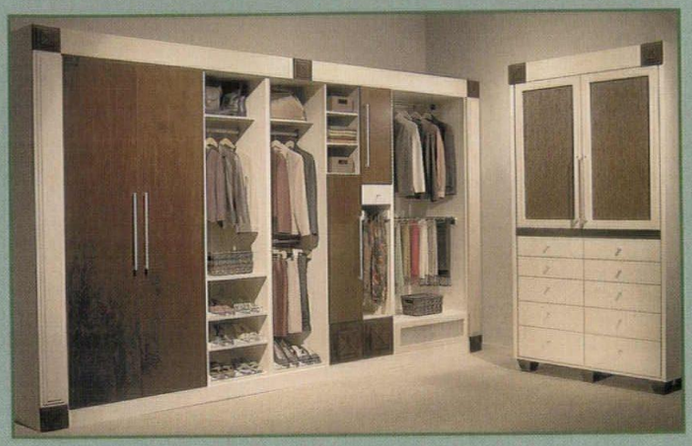

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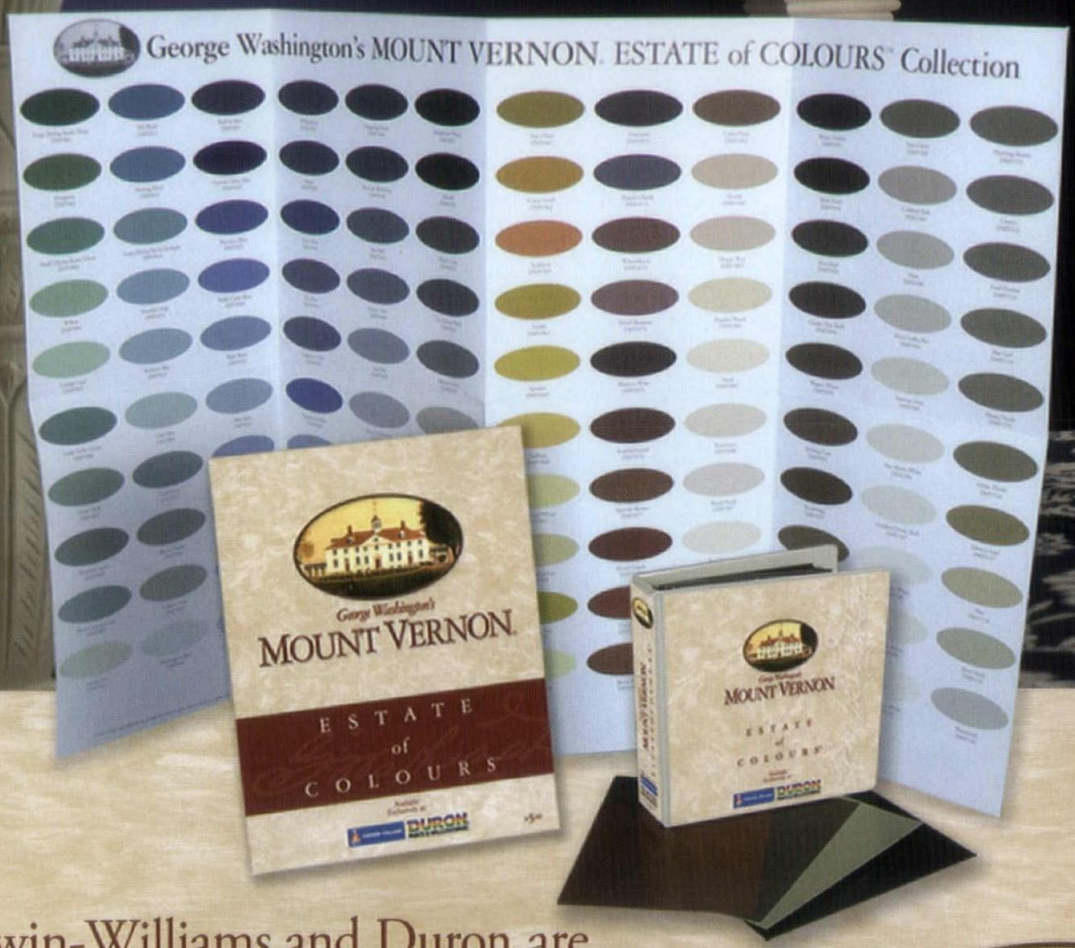

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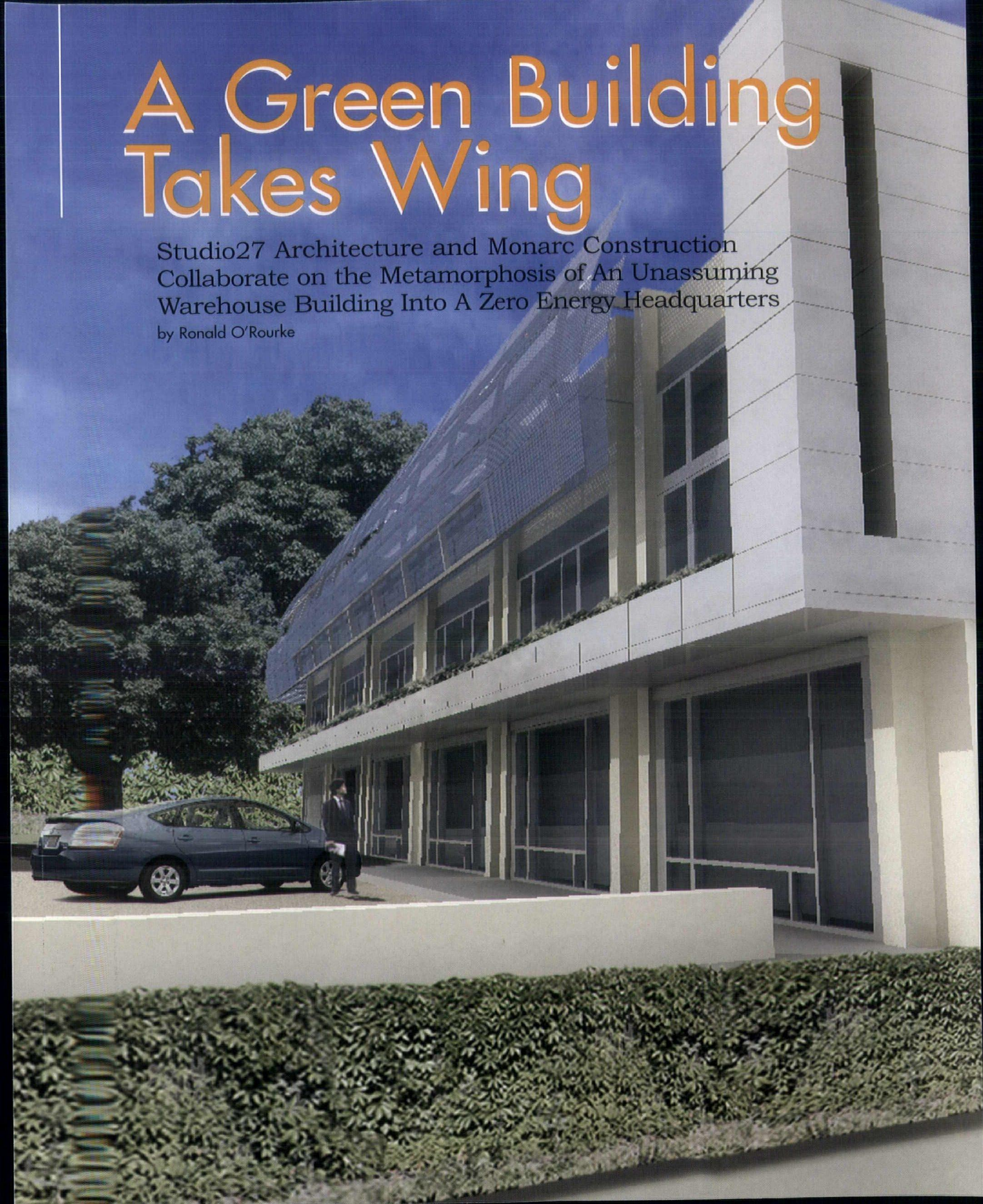
A Green Building Takes Wing

Studio27 Architecture and Monarc Construction Collaborate on the Metamorphosis of An Unassuming Warehouse Building Into A Zero Energy Headquarters

by Ronald O'Rourke



The climate in the DC area imposes significant heating and cooling burdens on local buildings, making it an unlikely place to attempt to build a net zero energy office building (one that generates as much energy as it consumes in a typical year). But John Bellingham, president of Falls Church-based Monarc Construction, set that as a goal for his company's new headquarters building. With the help of Studio27 Architecture, he expects to achieve it later this year.

To celebrate its 20th anniversary, Monarc will transform a drab, energy-inefficient, 1970s-era industrial structure into a sleek, zero energy headquarters that will demonstrate the firm's commitment to sustainable building design and construction. The renovated building will be Monarc's gift to itself, the community at large, and to the insect species for which the company is named, the Monarch butterfly.

Bellingham's search for an architecture firm led him to DC-based Studio27, headed by principals Todd Ray, AIA, LEED®AP, and John Burke, AIA. "We interviewed numerous firms to varying degrees," said Bellingham. "Forgetting price, what we wanted was a 'can do' attitude and a demonstration of good design. Our quest ended with Todd Ray and Studio27."

Bellingham asked Studio27 to design not just a zero energy building, but one that would qualify for LEED Platinum certification—the highest level of sustainable design certification granted by the U.S. Green Building Council (USGBC). LEED certification is based on credits that a building earns in five categories: sustainable site development, water conservation, energy efficiency, materials selection, and indoor environmental quality.

"About 5 years ago, Monarc Construction joined the Green Building Council," Bellingham said. "One of the GBC founders, David Gottfried, had worked with me at a prior employer, and I have a lot of respect for his energy and foresight. I believe that the building industry has to be brought into the 21st century, and by building our [own] green building using, in some cases, forgotten historic construction techniques which have been rediscovered, we can demonstrate what can and has to be done. When I thought about the degradation of the environment in my lifetime and the general disregard for the future of the environment, I realized I had to do my part."

"As this is our first LEED project, we were very excited about the opportunity," said Ray, who served as principal-in-charge of design for the renovation. "Once John had shared his full vision and his desire that the building be LEED Platinum, we focused all of our efforts to help him honor his commitment to the environment."

The existing 11,000-square-foot building, located at 300 Hunton Avenue in Falls Church, is a single-story industrial structure with a double-height ceiling. The renovation will insert a second floor into the existing volume, doubling the building's usable floor area, all of which will become office space for about 40 Monarc employees.

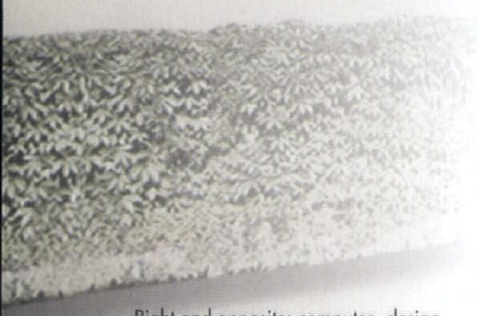
Design Inspiration

Studio27 adopted Monarc's namesake species as a design metaphor, with many elements of the building based on butterfly motifs that have an organic as well as aesthetic relationship to the building. Landscaping around the building will include milkweeds and other nectar sources that will allow the site to qualify as a registered Monarch Waystation, to provide vital life-sustaining habitat for Monarch butterflies migrating between their summer habitats in the eastern United States and wintering grounds in central Mexico. (The waystation program is managed by Monarch Watch, a project of the Kansas Biological Survey at the University of Kansas.) Pavers in the building's parking area will be laid in a pattern recreating the veins in a Monarch wing.

The most striking design element, however, is a boomerang-shaped screen suspended over two sides of the building. Dubbed the "solar veil" by its creators, the screen will shade the building during warmer months, reducing demand for air conditioning. The upper portion of the veil's surface will be covered with photovoltaic (PV) cells. Additional roof-mounted cells will result in a total PV surface area of approximately 2,000 square feet, generating electrical power that will further reduce the building's consumption of energy from off-site sources. The shape of the veil is reminiscient of an airfoil, suggesting flight, while its surface of PV cells and overlapping layers of perforated metal will have a butterfly-like iridescence.

The shape of the veil was determined intuitively, according to Ray, but was later found to have more than a metaphorical relationship to its original source of design inspiration. After the form was created, further research revealed that "it was exactly the shape of air-displacement diagrams of the wind beneath Monarch butterfly wings in flight. We then finalized the form through computer models and solar orientation studies." Placing the PV cells on the solar veil, said Ray, reflects a desire "to employ solar cells not simply as an engineered array of panels, but as a sculptural surface."

Inside, a two-story light core forms a spine along the building's length, and contains some of the building's offices



Right and opposite: computer design renderings of Monarc Construction Company Headquarters by Studio27 Architecture.

at the second floor. The tube-like core will transmit natural light entering from skylights above onto fabric filters and translucent walls, diffusing light to offices on the building's perimeter.

"The LEED rating system promotes visual access to exterior views and natural light even in the building core," noted Ray. "As far as we are concerned, this should be a feature of any well-designed building. We began to imagine ways to introduce daylight throughout the entire building, and arrived at the notion of translucent walls. When a caterpillar prepares for its final transformation into a butterfly, it spins a cocoon of translucent threads. We thought this was the perfect metaphor for the core of the building."

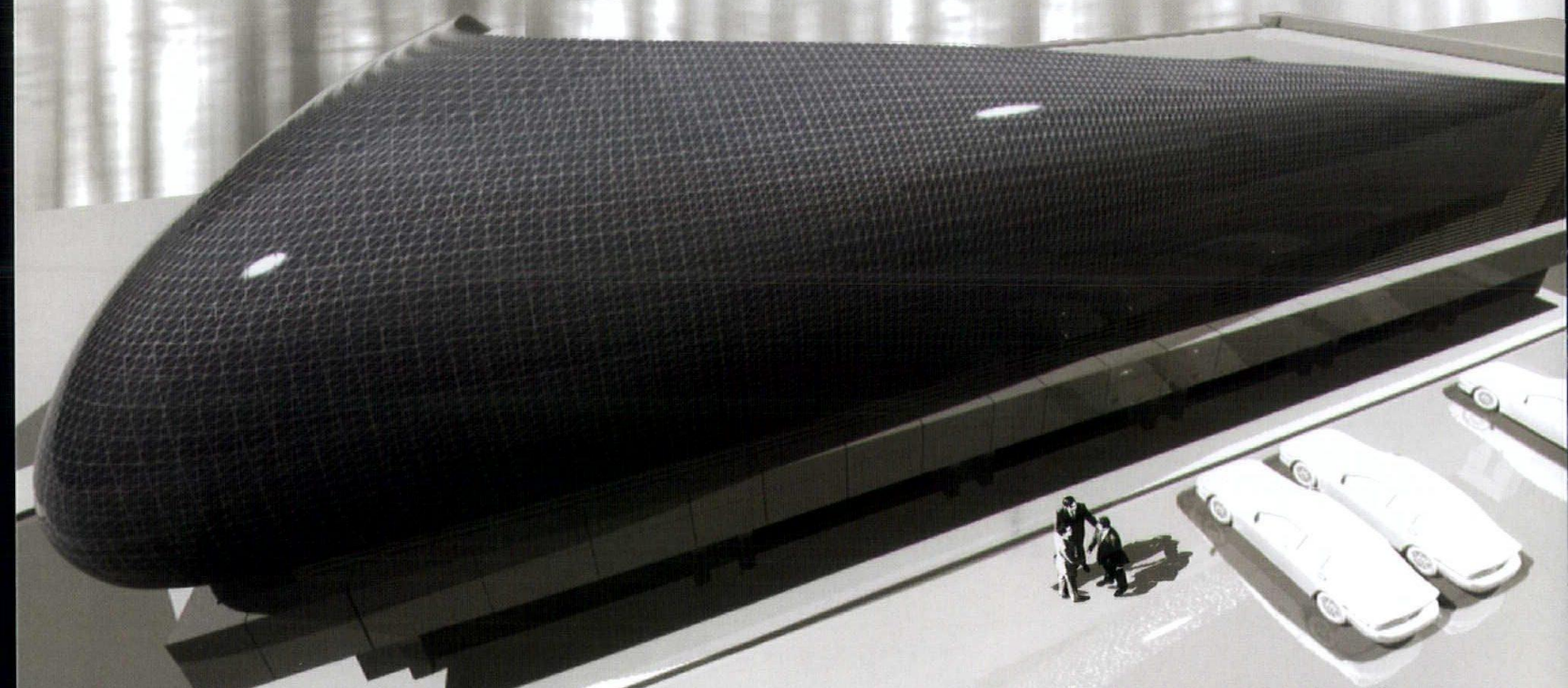
"The core is not actually an enclosed tube, but instead is defined by three curved surfaces," Ray continued. "Two are translucent walls, while the third is a tensile fabric structure suspended directly beneath the skylights. Together, they provide filtered light throughout the building throughout the day."

"The design is imaginative," Bellingham said. "I sometimes wonder how they came up with the concept. The space will be light and airy, yet simple and practical."

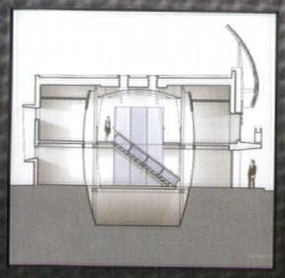
Sustainable Strategies

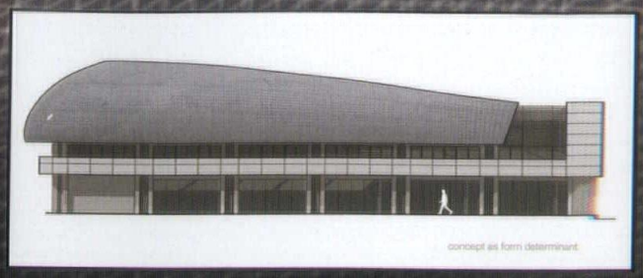
To achieve zero energy status, the design of the building will incorporate features to both reduce energy consumption and generate energy, including substantial insulation of the roof, walls, windows, and foundation; fluorescent lighting and light-emitting diode (LED) task lights; dimmable lighting controlled by photocells; a heating system that will recover and recirculate waste heat from lighting, computers, and people; and a geothermal (ground-source) heating and cooling system, which takes advantage of the Earth's near-constant below-surface temperature of about 55° F to both heat and cool the building efficiently. Design calculations based on energy modeling approved by the USGBC indicate that the building should be energy self-sufficient, generating as much power as it consumes over the course of a year.

"One may achieve a zero energy building simply by installing enough PV cells or other alternative energy sources to offset the energy consumed," said Ray. "but our larger goal is minimizing the overall environmental impact of the building." This means examining the total energy



Above: Computer design study of the proposed "solar veil" by Studio27 Architecture.
Top: Metamorphosis as a metaphor for the design process.





consumed in the building's construction—its "embodied energy"—as well as the energy consumed for the building's operation and maintenance. To the extent possible, Studio27 considered the amount of energy used to produce and install each element of the building, as well as the amount of energy needed to maintain the building or replace worn elements throughout its useful life. By selecting rapidly renewable or recycled materials, the firm was able "to create an elegant, functioning building with a long life expectancy [and] minimal facilities-maintenance issues," said Ray. Among the building's sustainable design features are low-flow plumbing; strawboard millwork; and adhesives, paints, and other coatings that are low in volatile organic compounds (VOCs), which are emitted into the atmosphere during drying or curing. The building will also capture storm water for irrigation and other uses.

"What I have found most intriguing about the pursuit of a zero energy building is re-imagining a building holistically or as a system," said Ray. "Not as an assembly of components each having their place, but as an interrelationship of all elements, including the occupants. There is a symbiotic relationship between the operation of the building, the socially embedded workday times, and the natural cycles of the earth and sun."

Ray emphasized that the Monarc project was a collaboration involving several firms, including Sustainable Design Consulting of Richmond, Virginia, Studio27's sustainability partner. "This is a team approach—the authorship [of the project] is collective," he noted. "We have a tremendous team of consultants for LEED evaluation and advice, geothermal energy, and MEP [mechanical, electrical and plumbing] for building systems."

Assessing Costs and Benefits

Constructing the building to meet the zero energy and LEED Platinum goals added to the cost of the renovation, but Bellingham believes it makes sense from a business standpoint. "Consider this," he said. "It costs about $4.00 per square foot per year to heat and cool an office building. It costs $400.00 per square foot per year to put the staff in a building. If we can improve the efficiency of our staff by 10 percent—and studies have shown that green design improves employee efficiency by at least 10 percent—this will add $40.00 per square foot per year to the bottom line."

"We have to reduce carbon emissions to slow down global warming," he added. "If we don't do this, it will make the 10 percent efficiency factor look very inexpensive. Building green clearly has many untold benefits we are yet to fully understand. But when the power goes out on a sunny, cold, or hot day, we will be nice and comfortable, having invested our money wisely."

Building codes are an important consideration to take into account in green design. "We need to build for the long term, but without redundant regulations," said Bellingham, "and we need to reduce the approval process time. Over the years, many redundant layers of code requirements have been left in place when new, updated code requirements have been implemented."

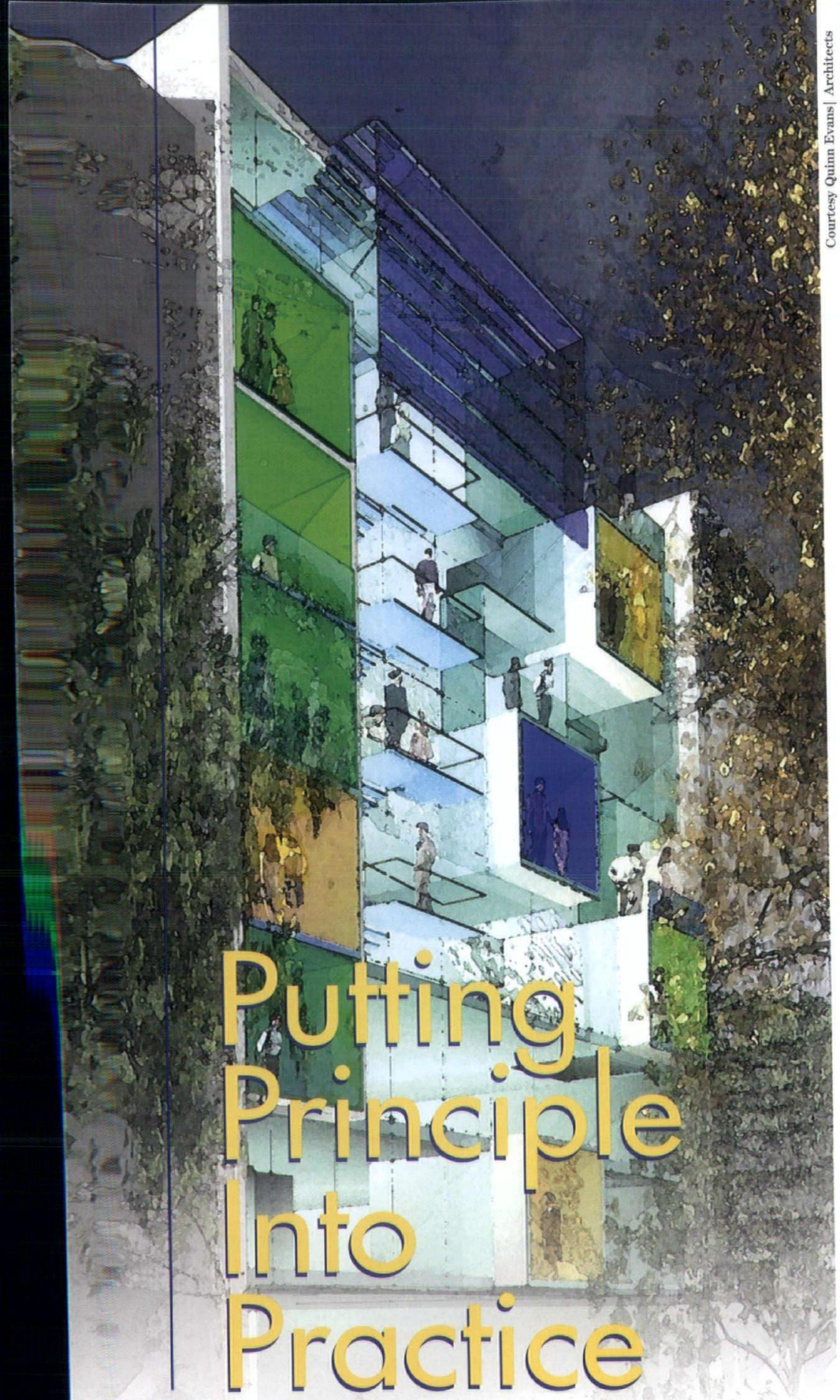
"Building costs need to come down," he added. "However, it is better for everyone and the environment if we build to last, with a life expectancy of 100-plus years for structure and envelope. We have to stop [building] low cost, disposable buildings. We must study life-cycle cost and demand or legislate the minimum life expectancy of all building projects."

Sharing Lessons Learned

Bellingham plans to use the renovated building as a green design showcase for inspiring others. "We intend to [invite] schools, universities, local government agencies, [and others] to tour the building, as well as clients, architects and our competitors," he said. "What we learn during the construction of our green building has to be shared if we ever hope to change the building industry, and thus, the public's opinion and perceptions of the building industry."

"In lieu of demolishing and constructing new, we salvaged the building and implemented green technologies," Ray said. "In the next century, many architecture projects will involve renovation or adaptive reuse. This project can be a model of how to do this responsibly."

When asked what advice he would give to organizations or homeowners who might be contemplating construction or renovation projects incorporating green design principles, Bellingham says: "I think the basic principle is to start with simple things and do what you understand and can accomplish easily. Clearly, putting in solar panels and geothermal wells to heat and cool—this will not be cheap. But when you focus on the long-term effects, the benefits will add up quickly."



Courtesy Quinn Evans| Architects

Putting Principle Into Practice

Environmental Nonprofits Walk the Walk

by Michael Tardif

Washington is home to many nonprofit environmental and professional organizations that exhort us to take better care of the planet. Three—the Ocean Conservancy, the U.S. Green Building Council, and the American Society of Landscape Architects—recently demonstrated that their commitment to a healthy environment is not empty rhetoric. Each has embarked upon or has recently completed a renovation of its own work environment.

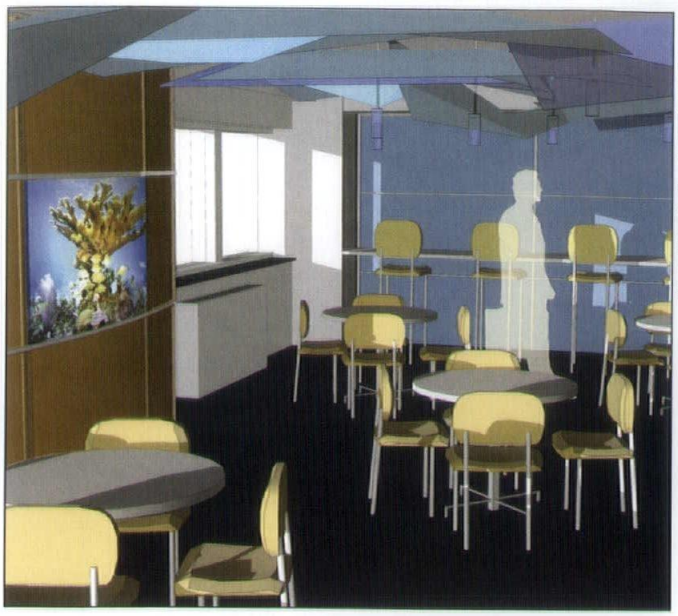
The Greening of K Street

The Ocean Conservancy, which promotes healthy and diverse ocean ecosystems and opposes practices that threaten ocean life and human life, is in the early stages of a long-term green renovation project of its DC headquarters. That is, they *were* planning a green building project until architect William McDonough, FAIA, suggested that the Ocean Conservancy's headquarters "shouldn't be the first green building on K Street, it should be the first blue building." And so was born the idea that the renovated building should be a visible symbol of the Conservancy's mission as well as a physical demonstration of sustainable design.

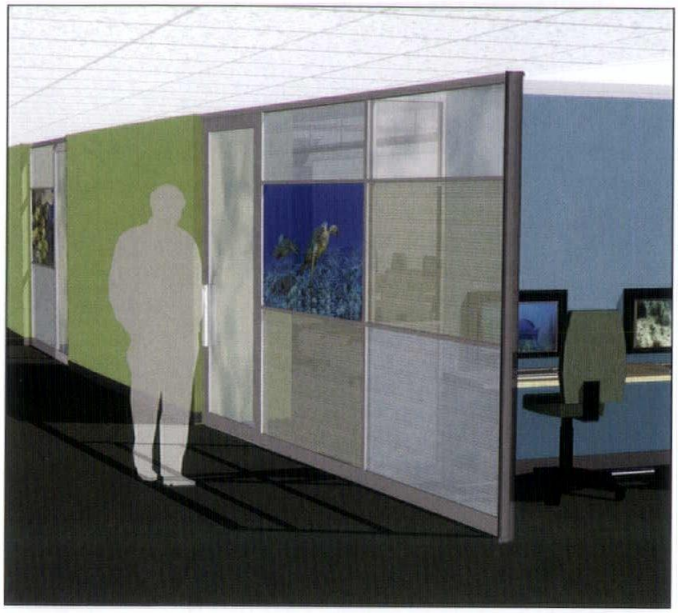
The two concepts happily coexist. The Conservancy's headquarters building is a typical mid-20th century mid-block office building, with precious little daylight penetrating the interior. The design concept calls for an atrium to be cut through the building, the now-standard sustainable design solution to the problem of bringing daylight deep into the interior of a building. But McDonough and his DC-based joint venture design partners, Quinn Evans | Architects, re-imagined the atrium in "almost kind of a fishtank approach," according to Quinn Evans principal Carl Elefante, AIA, LEED®AP. That led to a bold, transparent façade design unlike anything to be seen on K Street today.

For Elefante, sustainable design is "a practical philosophy, more like economic theory than hard science." Much of the recent renewal of DC office space is driven by the fact that the economic bar has been raised. "DC Class-A office space can no longer be stepchild of Class-A in Chicago," he noted. "But none of it has had a green dimension at all. In the 70s, 80s, and 90s, the commercial development mantra was 'give me larger floor plates.' Now we will be asked what to do with these giant floor plates. The answer seems to be cutting floor atriums into them to admit more light."

Elefante noted the results of a recent building industry survey published in *Architect* magazine, forecasting that U.S. construction in 2030 will consist of 54 billion square feet of rehabilitation and only 28 billion square feet of new construction. "We're really interested in [the Conservancy project] as a paradigm. What is the value of what you keep? What will happen to K street over the next 30 years? What will the greening of K Street look like?" The Conservancy design concept, said Elefante, is "a vision of the future." Implementation of the design awaits funding, but in



Courtesy Quinn Evans| Architects



Courtesy Quinn Evans| Architects

Above and opposite: Design studies for the Ocean Conservancy Headquarters.

the meantime Quinn Evans has begun executing a more modest interior renovation that meets the Conservancy's immediate needs while respecting the overall concept, so that the full "fish-tank" design can be implemented when funds become available.

Living the Green Gospel

The U.S. Green Building Council (USGBC) is the "earth mother" of sustainable design in the United States, dedicated to promoting buildings that are environmentally responsible, profitable, and healthy places to live and work. In the U.S., building codes are developed and promulgated by nonprofit organizations as "model codes" that are then adopted—in whole, in part, or with modifications—by federal, state and local governments.

Founded in 1993 to fill a perceived gap in sustainable design standards, USGBC developed the Leadership in Energy and Environmental Design (LEED®) Green Building Rating System™ that has since been adopted by 17 states and

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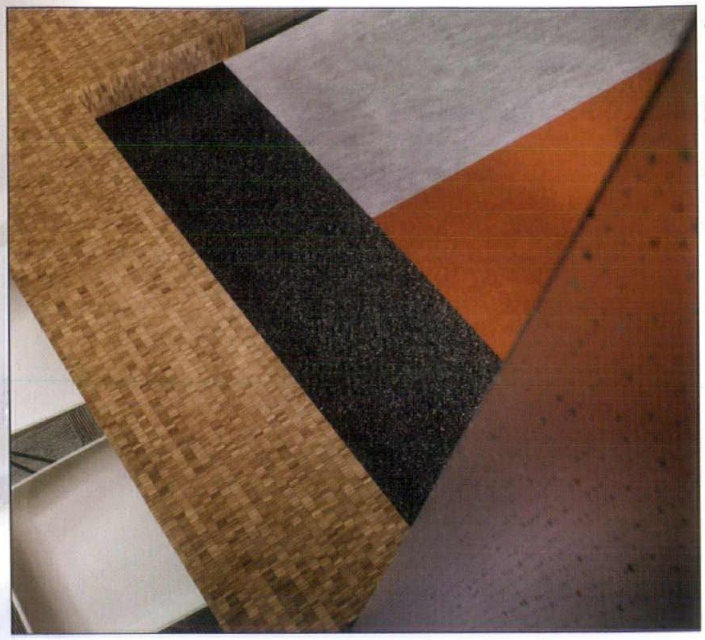

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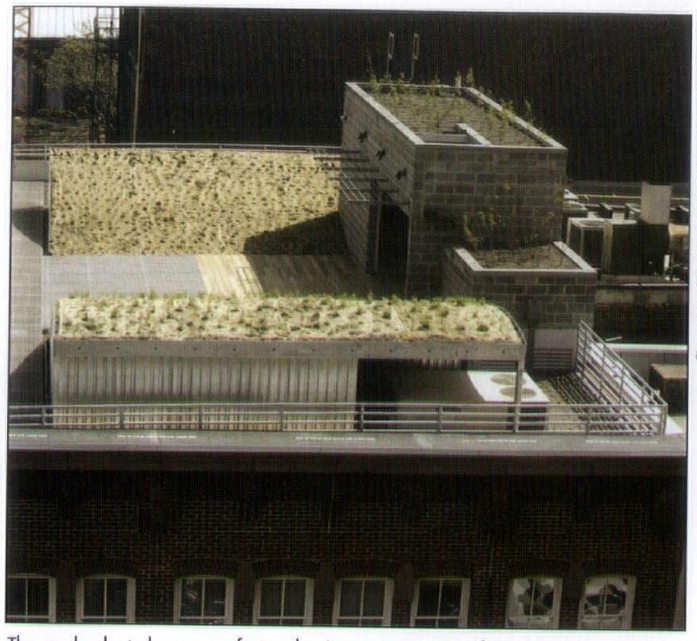
Above and left: The palette of eco-friendly materials incorporated into the new U.S. Green Building Council Headquarters.

61 local governments. In addition, many private property owners and federal government agencies mandate LEED certification for their buildings, whether or not it is required in the jurisdiction in which their buildings are built. USGBC now boasts more than 7,675 member organizations, including corporations, nonprofit organizations, and government agencies. More than 5,300 buildings have been registered for LEED certification to date, with 715 certified. The buildings are located in 12 countries, in all 50 states, and in the District of Columbia.

As the industry leader in sustainable design, it was a given that the design of USGBC's new 25,000 square-foot headquarters would be a self-evident example of the organization's principles: an office space that would support the productivity of USGBC staff, showcase sustainable design concepts, and serve as a laboratory for advancing the goals of the organization.

Designed by Perkins + Will, the project is designed to meet LEED-CI (for commercial interiors) Platinum certification standards, the highest level of LEED certification. It is also designed to demonstrate that sustainable design can be both extraordinary and ordinary. Offices are arranged to maximize access to daylight and exterior views. Nature is brought indoors with a low-height planter that helps organize an irregular column grid. Most spaces are designed for multiple purposes to increase the intensity (and efficiency) of use: office/conference rooms, library/pantry, conference/work rooms.

Finish materials include salvaged wood and materials reused either from USGBC's previous offices or already existing in the new office location, including glass panels, millwork, stone countertops, and terrazzo flooring. Varied flooring materials include bamboo, linoleum, and cork. Paints and other coatings were selected for low volatile organic compound (VOC) emission. The mechanical, electrical, and plumbing system were designed for optimal energy efficiency and performance. Variable air volume (VAV) diffusers, operable windows, and perimeter fan coil units allow staff individual control of temperature in their work areas. All appliances are ENERGY STAR rated, while all plumbing fixtures are low-flow, and include dual-flush toilets (full flush



Courtesy Forrester Construction Company

The newly-planted green roof atop the American Society of Landscape Architects headquarters building.

for solids, half-volume flush for liquids) and waterless urinals. Light fixtures, controlled by occupany (motion) and daylight sensors, were selected for light quality and energy efficiency. In a contractual arrangement with local energy utilities, 100 percent of the energy consumed by the USGBC offices is generated from renewable sources.

Shouting "Green" From the Rooftops

In another vivid example of "walking the walk, not just talking the talk," the American Society of Landscape Architects (ASLA) has hauled dirt and plants up to the 3,330 square-foot roof of its own I Street, NW, headquarters building to create one of downtown DC's first green roofs. The project is the product of the design and construction expertise of Michael Van Valkenburgh Associates, Inc., Conservation Design Forum, DMJM Design, Robert Silman Associates, and Forrester Construction Company.

"Landscape architects are leading many green roof projects across the U.S. and abroad, so it's only fitting that ASLA provide a demonstration project on this sustainable technology that can cure so many urban ills," said Nancy Somerville, executive vice president and CEO of ASLA. "We hope to provide a catalyst for more green roof development in Washington and beyond."

The advantages of green roofs include reduced heating and cooling costs and the potential doubling of the life span of the roofing membrane, which is protected from degradation due to exposure to sunlight and temperature fluctuations. To enhance the project's value as a demonstration project, ASLA has installed monitoring equipment to track stormwater runoff, water quality, and air temperature on its own roof and on an adjacent conventional roof, to provide comparative data. The collected data is available on **www.asla.org,** with visual coverage provided by a Webcam. A public tour of ASLA's roof will be held as part of DesignDC on July 19 at 11 a.m. Register online at **www.aaiadesigndc.org.**

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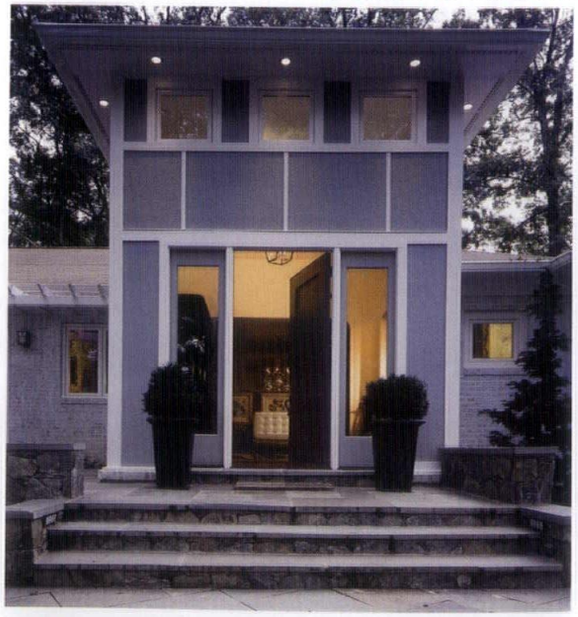

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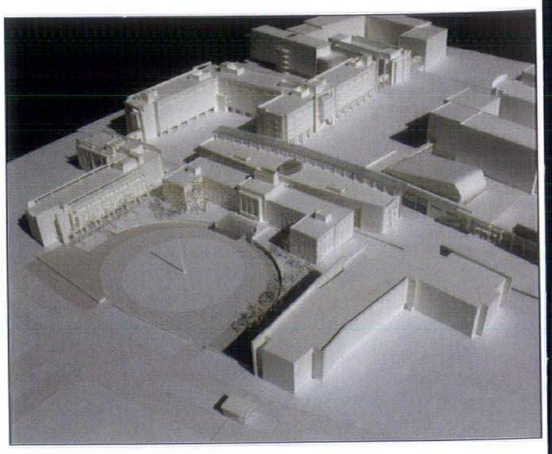
Blazing a Green Trail

Government Agencies Show Leadership in Sustainable Design

by Michael Tardif



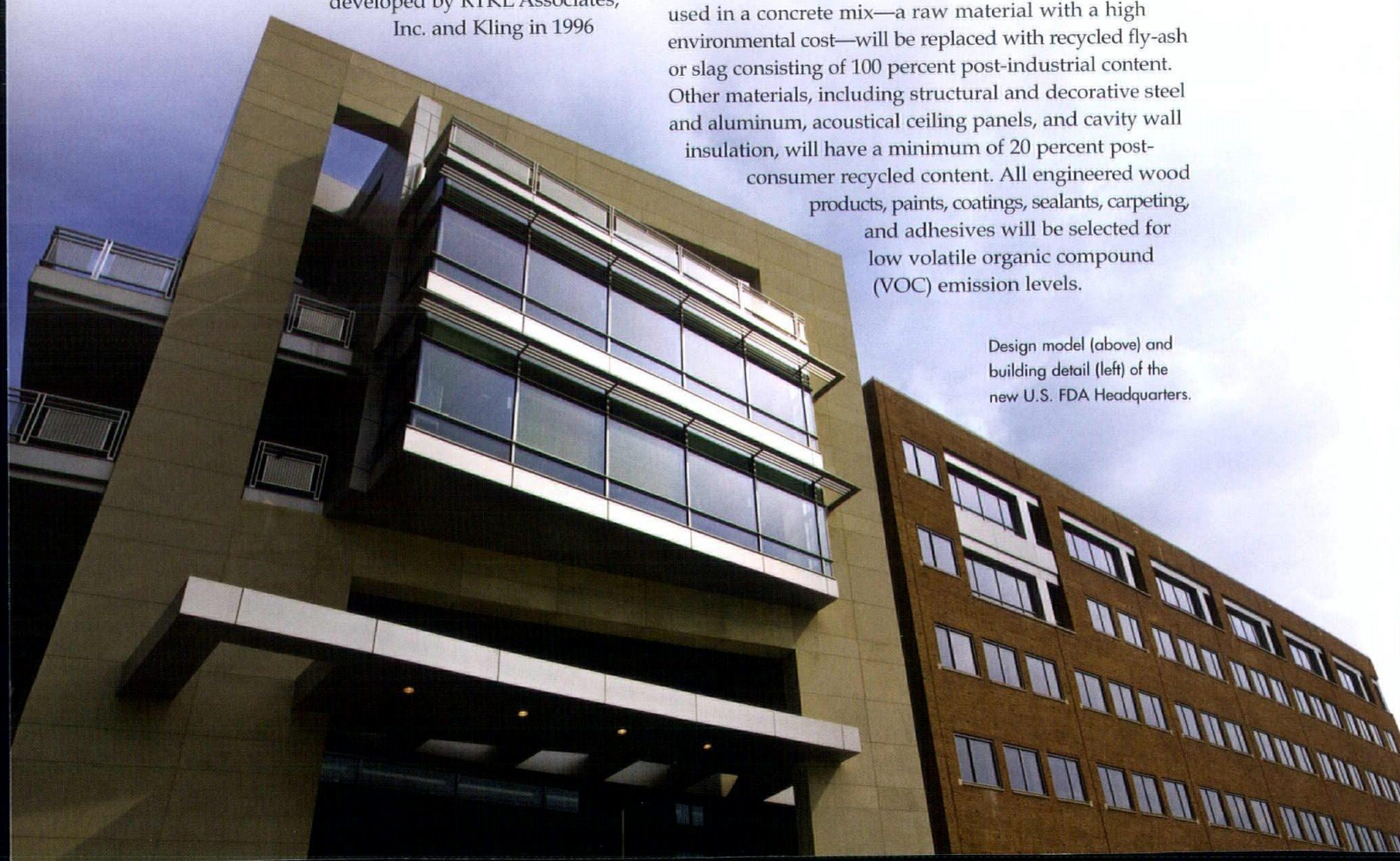
While nonprofit environmental organizations are setting an example (see "Putting Principles into Practice," page 16), federal government agencies are also integrating green design into their capital projects, in some cases at a massive scale that few other property owners can match. The U.S. General Services Administration is often the catalyst for sustainable design, but typically can count on enthusiastic support from its tenant/client agencies.

A Major New Campus for the FDA

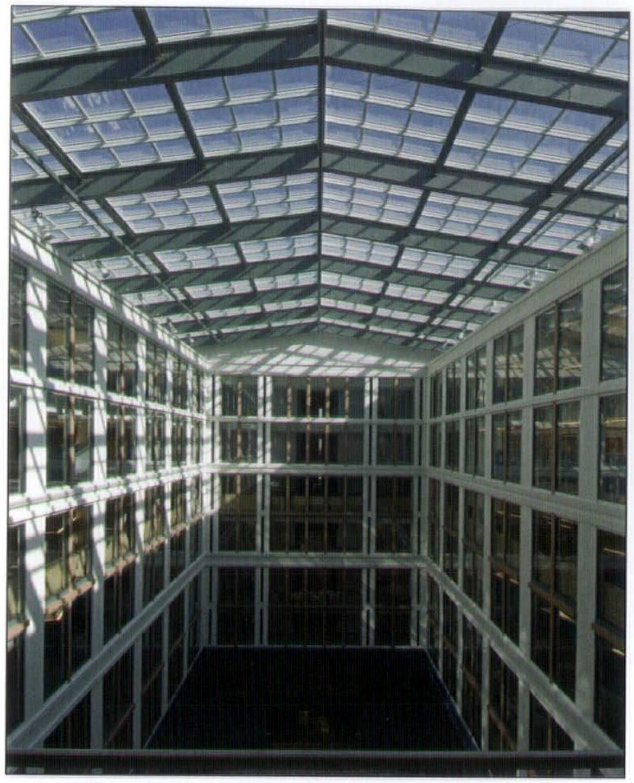
The U.S. Food and Drug Administration (FDA) employs over 6,000 people in 40 buildings at 18 locations throughout the DC metropolitan area. By 2010, the FDA's facilities will be consolidated in a single campus formerly occupied by the Naval Surface Warfare Center at White Oak, Montgomery County, Maryland. The master plan developed by RTKL Associates, Inc. and Kling in 1996 will configure the 16-building, 2 million square-foot campus into a compact, pedestrian-friendly headquarters facility.

The size of the campus will allow for on-site stormwater management and power generation. Dedicated storm drain lines will lead to a new stormwater management facility, while bio-retention areas in the immediate vicinity of buildings will treat runoff from impervious surfaces. Landscaping will consist of low-maintenance, indigenous plants that will require no irrigation. A co-generation plant, designed by Sempra Energy Services, will use photovoltaic (PV) panels and dual-fuel generators to supply power, chilled water, and domestic hot water. Waste heat from the generators will be transferred to the buildings' HVAC systems. Any excess power generated will be sold to utilities through the power grid system, helping to reduce the need for new power plant construction elsewhere.

Up to 50 percent of the Portland cement normally used in a concrete mix—a raw material with a high environmental cost—will be replaced with recycled fly-ash or slag consisting of 100 percent post-industrial content. Other materials, including structural and decorative steel and aluminum, acoustical ceiling panels, and cavity wall insulation, will have a minimum of 20 percent post-consumer recycled content. All engineered wood products, paints, coatings, sealants, carpeting, and adhesives will be selected for low volatile organic compound (VOC) emission levels.



Design model (above) and building detail (left) of the new U.S. FDA Headquarters.



Maxwell MacKenzie Photography

Maxwell MacKenzie Photography

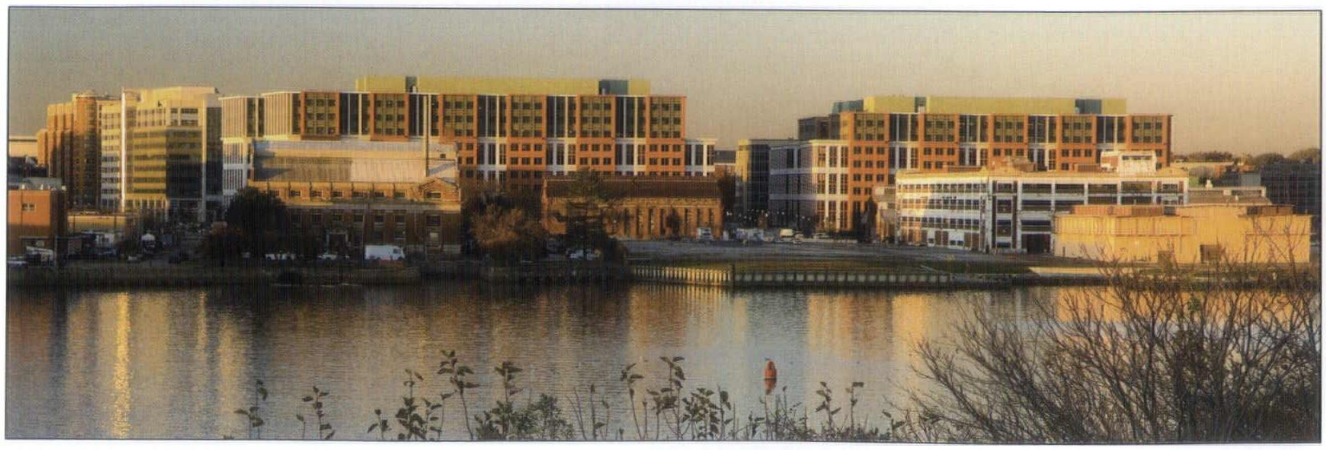
Above, right, and below: The new U.S. Department of Transportation Headquarters, by Michael Graves & Associates and DMJM Design.

Individual buildings are being designed by RTKL to take advantage of their individual solar orientations, with features such as horizontal "sun fins" on the south sides to reduce heat gain from the hot summer sun, and vertical fins on east and west sides to shield occupants against the harsh glare of low morning or afternoon sun. The Center for Devices and Radiological Health, to be completed in 2008, will feature a saw-tooth skylight that takes advantage of the building's orientation to maximize natural daylight throughout the building.

U.S. DOT Builds First New DC Cabinet-level Headquarters in 30 Years

Cabinet-level departments of the U.S. government continue to grow as the nation grows, beyond the ability, in some cases, of our capital city to accommodate them. The new U.S. Department of Transportation Headquarters, however, is nearing completion on 11 acres of the 55-acre Southeast Federal Center, located along the Anacostia River adjacent to the Washington Navy Yard. At 2 million square feet, it rivals the FDA Headquarters in size, but accomplishes the same goal of consolidation on a much smaller, urban site.

Designed by Michael Graves & Associates of Princeton, New Jersey, in partnership with executive architect DMJM Design of Arlington, the design of the building deliberately aims to create a vibrant city streetscape of seemingly smaller buildings, rather than a massive single structure. The project is actually two separate buildings separated by an open-air plaza but connected by an underground concourse. The apparent mass of the buildings is further broken down by U-shaped



Maxwell MacKenzie Photography

plans that create new urban courtyards and maximize the number of office spaces with exterior light and views. Glass-enclosed atriums at the interior of both buildings provide an unprecedented degree of access to daylight for workers in a DC federal office building.

Though the design began well before the GSA mandated LEED certification for federal projects, the design team consistently adhered to sustainable design principles from inception. Among the building's sustainable features are its location on a reclaimed brownfield site, adjacency to mass transit, adherence to energy efficiency standards for mechanical equipment and systems, and an enormous green roof.

National Park Service Brings Nature Indoors

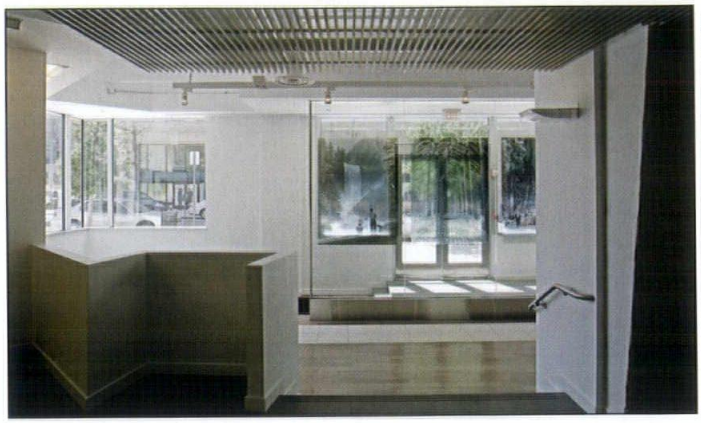
Consolidation seems to be a driving force for sustainable design of federal facilities. As a champion of the environment, The National Park Service, upon receiving news of a required relocation and office consolidation, decided that it wanted the "greenest" facility possible within the time and cost constraints of the project. The NPS began by negotiating an innovative "green lease,"—the first in DC—that established sustainable design criteria that the building owner had to meet in its lease obligation, including waste management, recyling, reduction of harmful emissions, and other criteria related to building operations and maintenance.

In addition to widespread use of green materials, the facility features a green lighting system that can be controlled from individual workstations and that is tied to an energy savings program. The location in a speculative office building posed unique challenges from an energy efficiency standpoint. Building owners are accustomed to passing energy costs on to their tenants, and thus have few incentives to conserve.

Though most sustainable design attributes of buildings are not apparent to the casual observer, Group Goetz Architects made judicious use of large-format photographs, color, and glass in their design to reflect the image and mission of the National Park Service and call attention to the headquarters' sustainable design features.

Right, top to bottom: The new U.S. National Park Service headquarters by Group Goetz Architects.

Ron Solomon Photography



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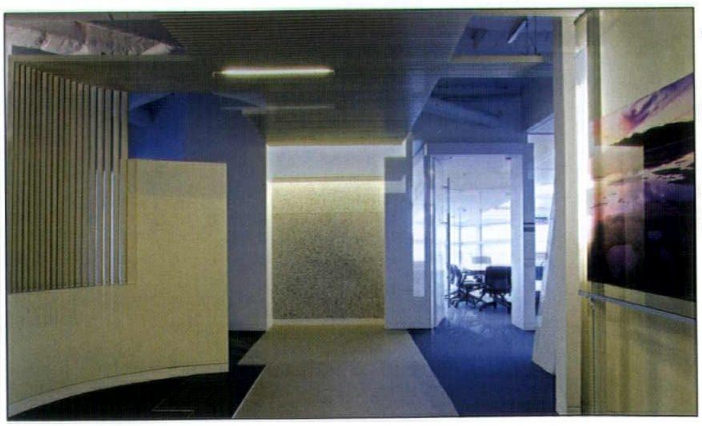

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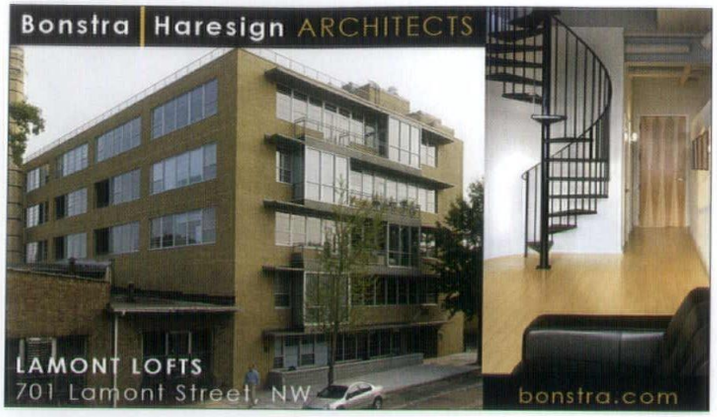

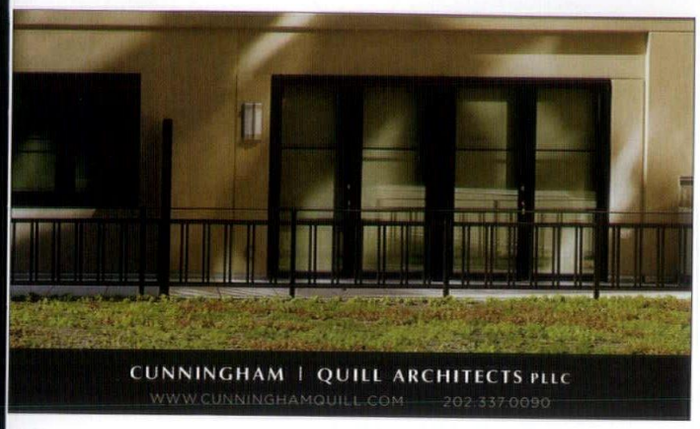

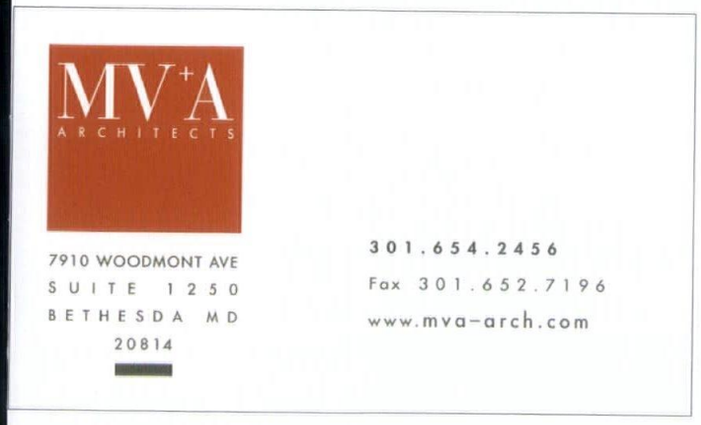

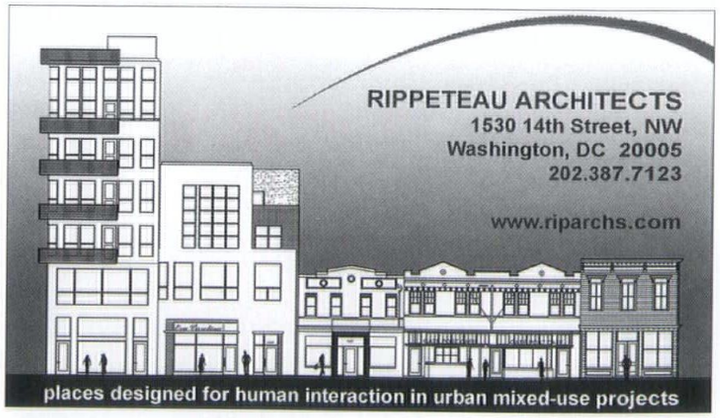

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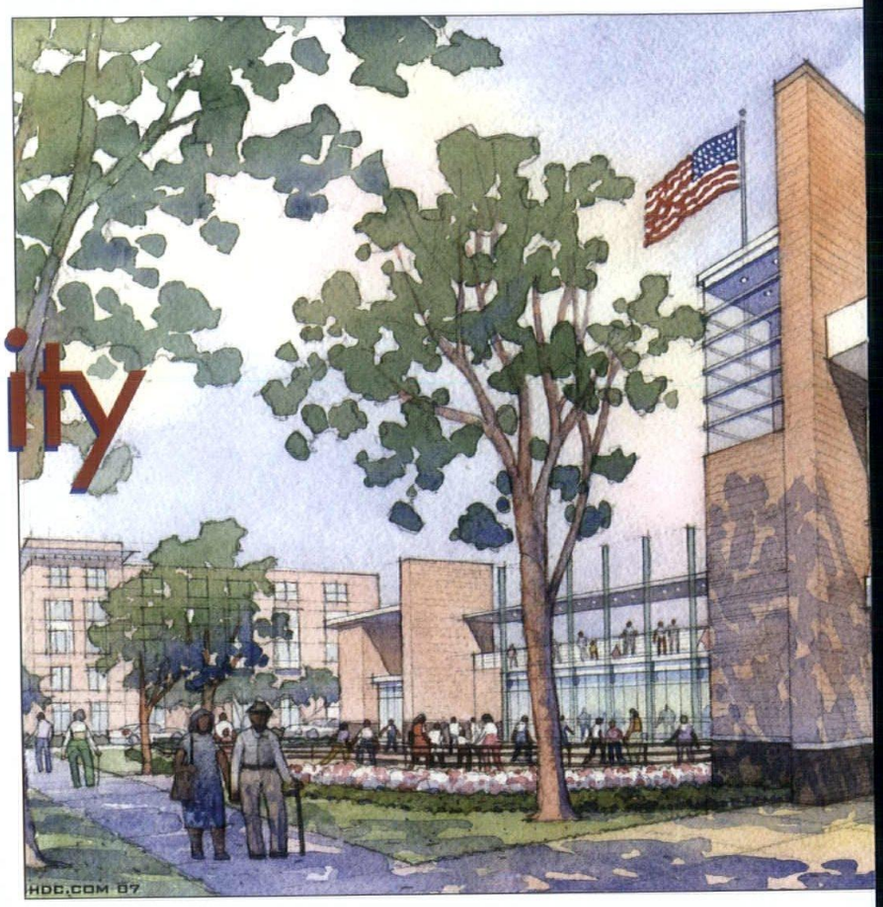


Above and below: The proposed Capper/Carrollsburg Community Center by Torti Gallas and Partners, Inc.

In urban Southeast Washington and in suburban Arlington County, Virginia, community center planners and designers have drawn the same conclusion: Sustainable design makes a world of sense. Whether one's goal is altruistic—to preserve the earth's resources, minimize a facility's impact on the land, or provide a comfortable, non-toxic environment for building occupants—or monetary—to heat, cool, light, dispose, or recycle as inexpensively as possible—sustainable design achieves both. Everyone wins.

Capper/Carrollsburg Community Center

In Southeast DC, the Capper/Carrollsburg neighborhood is experiencing a transformation just a stone's throw from nearby federal, commercial, and baseball stadium construction projects. Launched in 2001 with a multi-million-dollar grant from the U.S. Department of Housing and Urban Development's HOPE VI program, the neighborhood development plan will replace the area's most severely distressed housing. As planned, the community will gain livable housing and a more thorough a mix of housing types, retail, and office uses.

In the center of this renewed community, a new Capper/Carrollsburg Community Center will replace an impervious, red brick, sparsely-fenestrated structure that currently occupies the site. Notable not only for its more welcoming appearance, the new center, designed by Torti Gallas and Partners, Inc., of Silver Spring, Maryland, represents another triumph: It incorporates sustainable design at a level higher than any previous DC Housing Authority project, a level higher than required at the time of design, and implemented purely at the discretion of the DCHA. The center is registered with the U.S. Green Building Council for LEED certification upon completion.

Noting that DCHA sought to lessen the environmental impact of the development on the site as well as minimize the cost of operation, Torti-Gallas principal Cheryl O'Neill commended DCHA's championing of sustainable design, adding, "We are a green firm, and sustainable design is integral to the design process."

Sustainable highlights include an extensive green roof system, with the dual benefit of insulation and storm water retention; efficient lighting fixtures and controls; and a tight thermal envelope. Together, these features are expected to result in energy efficiency that exceeds by 20

DariushDC Illustration

percent the requirements of ASHRAE 90.1, an industry standard that promotes energy conservation while providing for the visual and thermal comfort of building occupants. Meanwhile, the center's water systems and water-efficient plumbing fixtures will reduce consumption of potable water by 40 percent.

Sustainable design and construction strategies will begin with the demolition and construction phases; a construction waste management plan will minimize waste disposal and maximize recycling of construction waste.

The new center will serve multiple constituents and many planned uses. The building will include a gymnasium, exercise room and locker facilities, a computer lab, meeting room, community office space, a high capacity kitchen, daycare to serve 66 neighborhood children, and two playgrounds—one on the building's green roof. The design team has completed construction documents, with construction to begin in 2007 subject to available funding.

Walter Reed Community Center

Across the Potomac River in Arlington County, Virginia, the new Walter Reed Community Center addresses similar issues. The aging existing community center no longer adequately supported the needs of the community it served and required replacement.

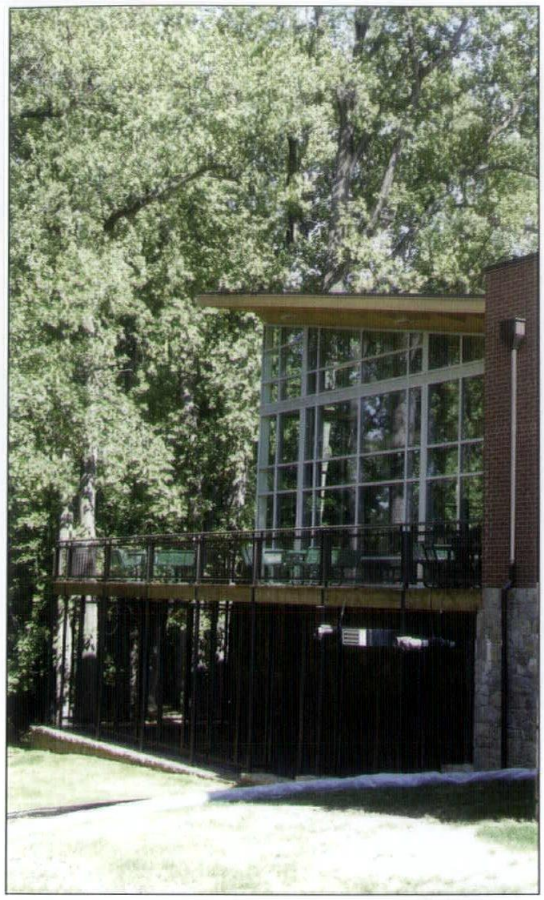
Like the Capper/Carrollsburg Community Center, the Walter Reed center also benefited from a client and ultimately two architectural teams who were committed to minimizing the impact of a new facility on the environment. (The design was originally developed by Cooper-Lecky Architects, PC, before migrating to RTKL Associates, Inc., when Cooper-Lecky closed its doors.) Client and architects collaborated to design a community center that not merely met but surpassed sustainable design requirements while addressing residents' needs.

From the start, the grounds and building were designed to achieve a LEED Silver rating from the U.S. Green Building Council. With construction complete and the center in operation since May 2006, LEED documentation and certification is in the final stages. The landscape design includes bio-retention areas and permeable paving surfaces to enhance storm water absorption and reduce reliance on municipal stormwater systems. The building's green roof, comprising over 65 percent of the roof area, absorbs additional stormwater and enhances insulation. Integrated solar shading above the large expanses of windows reduces the cooling load in summer months. Operable windows, extensive glazing for exterior views, and abundant natural daylight afford additional user comfort.

Much of the interior features materials from sources that are rapidly renewable. In meeting rooms and in special activity areas such as the gymnasium and dance/exercise room, floors are cork or bamboo. Wheat fiber panels, similar to but finer in finish than particle board, add the warmth associated with wood surfaces without taxing slow-growth hardwood forests. The design also conserves water through the use of motion sensors, low-flow toilet fixtures, and water-free urinals, while the construction waste management plan is estimated to have diverted 79 percent of the construction waste from landfills. Reducing waste even further, the design incorporated stone from the community center that previously occupied the site in new landscaping walls.

The new Walter Reed Community Center—with game room, quiet room, café, meeting rooms, offices, and a senior center—is poised to sustain its community for many years to come.

Torti Gallas + Partners, Inc.



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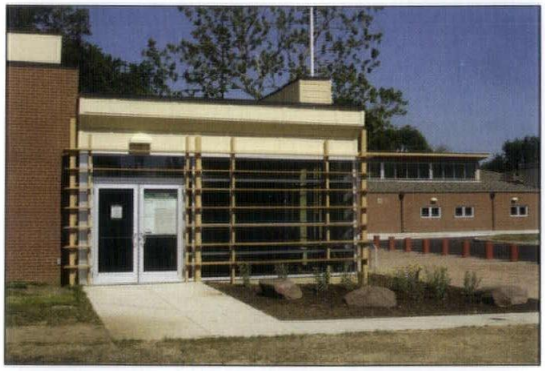

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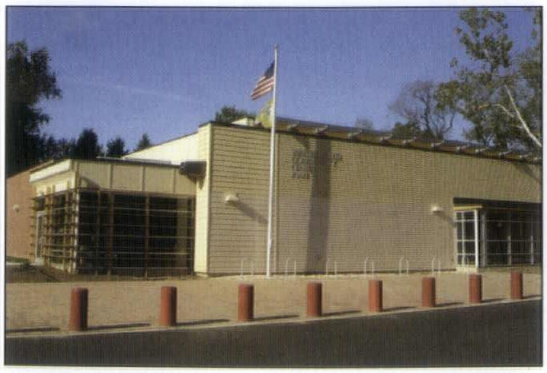
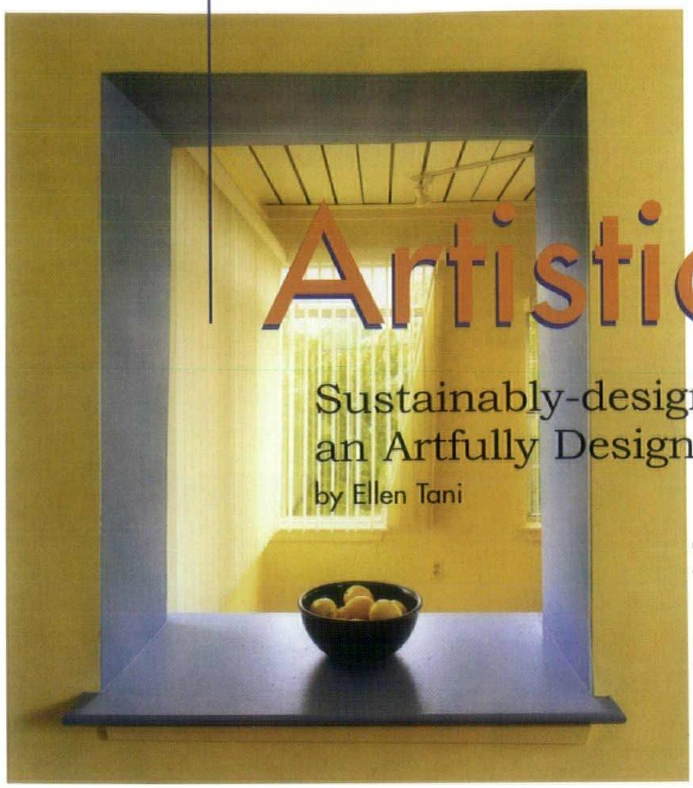


RTKL Associates, Inc.

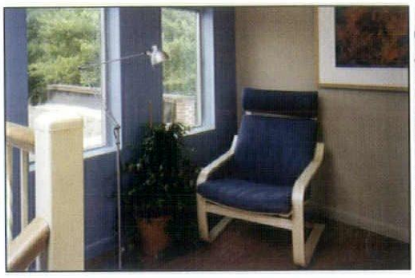
Above, top to bottom: The Walter Reed Community Center, Arlington, Virginia, by RTKL Associates, Inc.



Artistically Green

Sustainably-designed Artists' Housing and an Artfully Designed Sustainable Home

by Ellen Tani



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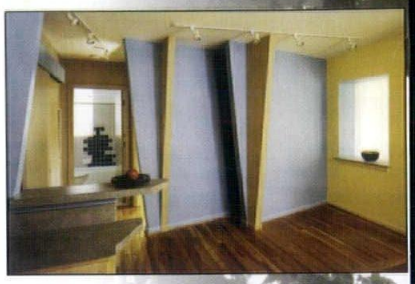

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Sustainable design often conjures up "crunchy granola" houses with ugly rooftop solar panels, dim lighting, concrete floors, and a fervent commitment of the occupants to hemp and wheatgrass. Two recently completed projects—one a multi-family building for artists, the other a single-family home—overturn common preconceptions of green design. They show that sustainability can be affordable, that "extreme green design" can be the most effective, and that sustainability can be achieved without sacrificing aesthetics. They also show that sustainable design can produce fun, affordable, and beautiful places to live.

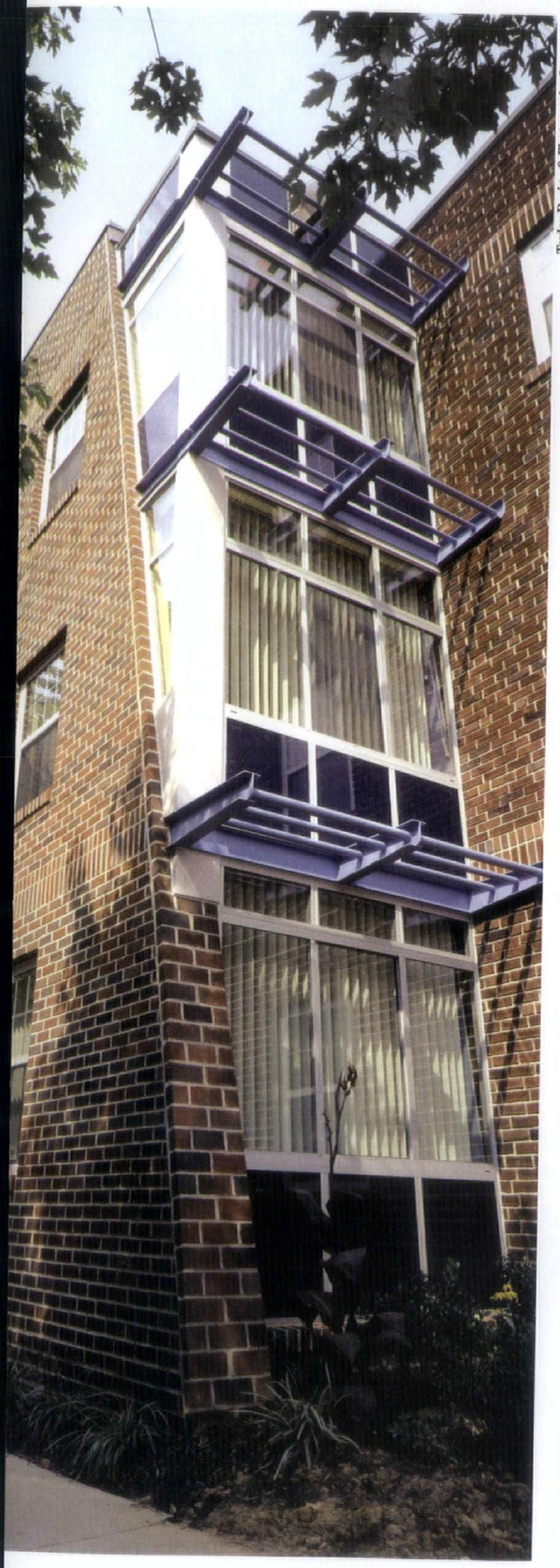
Sustainable, Affordable, and Creative

An affordable housing complex that has won eight awards in three years, the Housing Initiative Partnership (HIP) Artists' Housing in Mount Rainer, Maryland, is the result of a public-private partnership that turned a community nuisance and eyesore into twelve fun, affordable apartments for artists.

The renovated building, designed by Wiencek + Associates Architects + Planners, PC, of Gaithersburg, is the first new artists' housing in the Gateway Arts District of Prince George's County, the product of a county sector plan aimed at reinvigorating communities along U.S. Route 1 that includes Mount Rainier, Brentwood, North Brentwood, and Hyattsville. By creating a district specifically dedicated to artists and cultural organizations, the County hopes to spur economic growth, strengthen existing arts resources, and cultivate distinct and coherent community identities along the nondescript commercial corridor.

Creating live/work spaces for artists was viewed as critical to the formation of the arts district. Wiencek + Associates considered local history, art, and environment as design parameters. Adaptive reuse of an existing building in a walkable neighborhood, streetscape improvements, and environmental preservation are only the "baseline elements" of their sustainable design process. The architects preserved the building's architectural character but added two studio bays along the street that appear to be extruded from the original masonry wall. The outer walls of these bays match the existing building exactly in terms of brick color and window pattern, while the side walls are glass curtain walls, shielded from the summer sun at each floor by a steel brise soleil. The "extruded" brick wall of one of the bays is angled sharply along one edge from the ground to the roof, from which the curtain wall emerges as a form in its own right. The effect signals that the bays are new, not historic. Inside, studio spaces are vibrant, colorful, and lively. Open floor plans accommodate a variety of living and working styles, maximize light exposure, and help minimize heating and cooling loads. Careful attention to interior details and finishes, including such resident-artist needs as light courts and mess sinks, distinguishes the building from others in the affordable housing sector. Many green building materials were selected for durability and long life, reducing maintenance and replacement costs. Existing wood floors were sanded and refinished, while bathroom tiles made of recycled glass and car windshields add color and texture.

Energy-saving sustainable features benefit residents in the form of lower utility bills, an important but often overlooked component of making housing affordable. Existing operable windows were replaced with double-pane insulated units filled with argon gas and finished with a low-emissivity (Low-E) coating that reduces solar gain in summer, while tankless hot water heaters, highly efficient HVAC systems, and a green roof (the first in Prince George's County) help minimize energy consumption without sacrificing comfort. Planted with



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sedum and a bird house to attract local wildlife, the green roof doubles as residents' only common area, since the compact site allowed little outdoor garden space and the limited floor area precluded an indoor community room. Exterior landscaping incorporates a bio-retention pond for stormwater management, while wind sculptures, birdhouses, and colorful garden pieces reveal the building's artistic identity.

HIP Artist's Housing not only succeeds as a creative, sensitive, and affordable design solution and community improvement, it also sets an example as architecture that goes the extra mile to promote sustainability. Though no supplemental funds were included in the budget for sustainable features, the architect and developer were able—with creativity, ingenuity, and a little extra effort—to create an environmentally sustainable and financially responsible affordable housing complex. With an uplifting design to match its program, HIP Artists' Housing sets the bar high for affordability, sustainability, and design excellence in the Gateway Arts District.

Sustainable Design to the Limit

The Hutchins Residence in Takoma Park, Maryland, is an exceptional example of sustainable design as both process and practice. Bill Hutchins, AIA, who designed the renovation and addition to this 1890s bungalow for himself and his family, is a walking, talking model of sustainable design philosophy. And his home reveals that, far from imposing a Spartan existence on its adherents, sustainable living can be luxurious.

It's clear that Hutchins has not forgotten what it's like to be a child—to experience a constant and vital engagement with the world. His design process draws equally from spontaneity and intention. With the technical know-how to utilize energy-efficient systems, the social conscience to support local businesses, and the ability to embrace impromptu design inspiration, he has created an extraordinarily eco-friendly home that reflects the character of its inhabitants and sustains and involves the local community. This is "green design to the max," with no unsightly rooftop barnacles or other "crunchy granola" trappings to give it away.

The house unfolds like a song in an expressive and poetic series of moments. Playful yet thoughtfully integrated peculiarities—a wire piggy tail protruding from a ceiling beam, a countertop mosaic of tile samples, an interior wall clad in weathered shingles, a sculpted steel stair railing—begin to convey the big idea. Whimsy, vitality, and spontaneity are essential to the design of this house.

The soft, mottled walls are made of straw bale with earthen/lime plaster, providing high-efficiency thermal protection all year. The interiors emanate warmth with rich honey tones, soft textures, and intimately carved spaces. As one passes from room to room, it's as if the inside of a tree has been peeled off and applied to the walls. The lustrous wood floors, ceiling beams, and walls are either existing or were obtained from Community Forklift, a local business that sells surplus and salvaged green building materials. Hutchins used a simple

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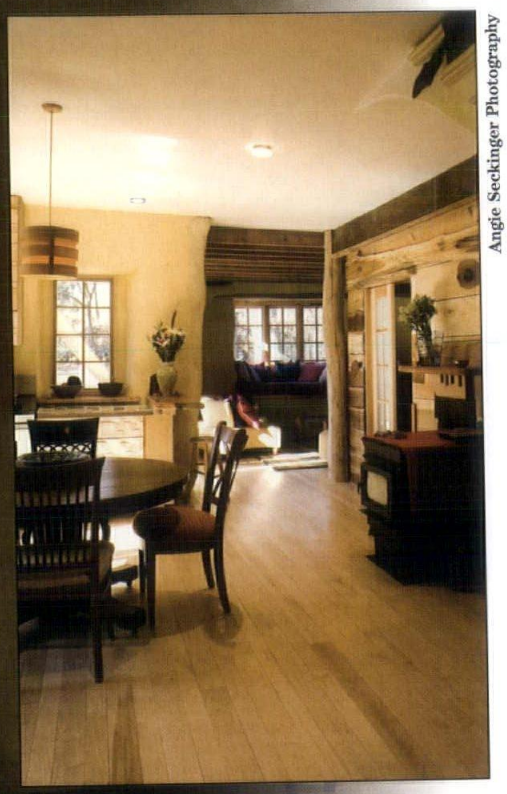

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wood-planing technique to bring old wood back to life, revealing a new layer while preserving the structural integrity of load-bearing elements. Nearly all newly-incorporated materials were salvaged: framing lumber, windows and doors, plumbing fixtures, stone for terraces, even Silestone.

A rustic stove heats 90 percent of the house with no carbon dioxide emissions by burning corn, a renewable resource. A biodiesel-fueled radiant floor system provides any remaining needed heat, and is the sole source of heat for the 600 square-foot basement apartment. The heating bill for an entire year—for a house that is over 3,500 square feet—is only $300.

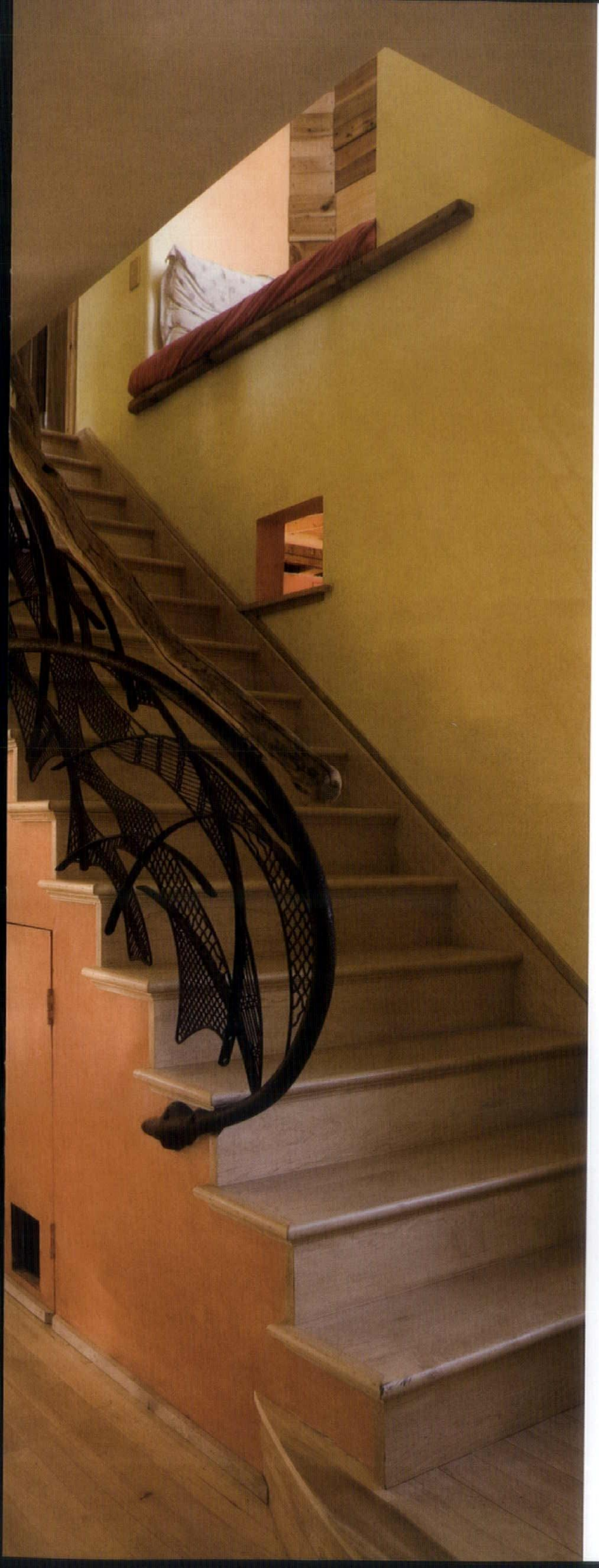
Hutchin's commitment to sustainability doesn't stop at the front door. The same biodiesel fuels the family's cars, which are rarely used in place of the Metro, only one block away.

In his everyday activities and in his architecture practice, Hutchins strives to live the motto "Think Globally, Act Locally" by supporting local businesses. As an active member of the Corn Co-op (an organization of corn stove users), Hutchins visits the silo regularly to buy fuel for his house. For construction, he hired local laborers (students as well as professional crews), and even organized community work days where volunteers traded a day's labor for a day's worth of hands-on education in sustainable building practices.

Though the two are not typically considered in the same context, historic preservation is a sustainable design strategy, since by definition it extends the useful life of existing building materials, reducing the need for harvesting and manufacturing new materials. The location of Hutchins' late-19th century bungalow in Takoma Park's Historic District mandated that the existing structure remain largely unchanged when viewed from the street. By removing the second floor (whose wood was refurbished to create the new floor), Hutchins converted the existing 700 square foot space into a large, double-height front room that serves as an art gallery, living room, and community meeting space. For what he could not change in the front of the house, he more than made up for in the rear, with a 2,700 square-foot addition that houses two home offices, a kitchen, a basement apartment, and three bedrooms (three generations share the home, seeking the maximum appropriate density for their residential neighborhood).

Behind the house is another ecosystem entirely. A beautiful and sophisticated stormwater management garden, complete with retention pond, wetlands, a rain garden, and permeable pavers, is the last element of the project. In addition to its ecological function, the garden provides a soothing and beautiful view from the open-air sleeping porch, a luxurious yet simple space that opens from the master bedroom.

"I have done architecture with a capital A," says Hutchins. "I worked for 13 firms before I went out on my own, from the major players to the small two-man shops. But I came to a point in my career where architecture felt hollow. I wanted a deeper relationship with places and people." And so emerged a conscience that honors the relationship between humans, their environment, and the soul of a home. "We tend to live in buildings as we ride in powerboats, unconsciously flipping switches on and off," said Hutchins, "rather than considering them as sailboats: vessels that can, through our engagement, put us in more intimate relationship with the elements and loved ones with whom we live."



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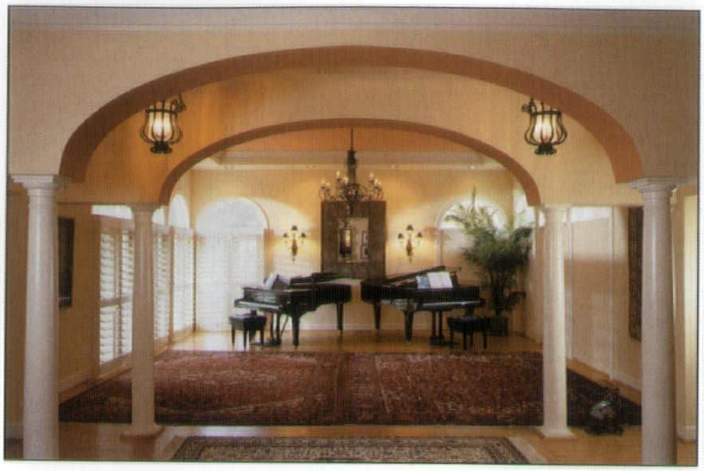

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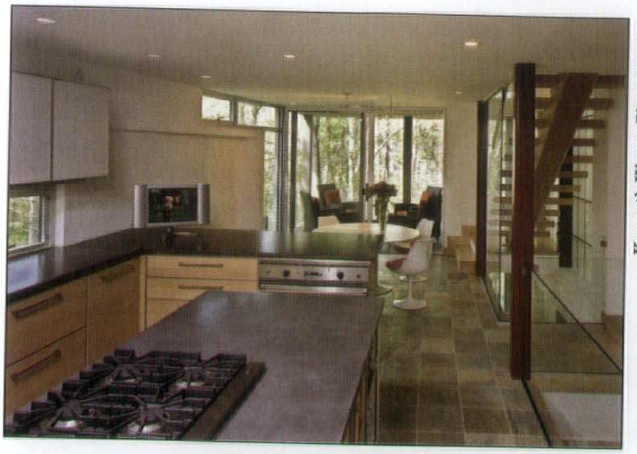
Sustainably Modern

For Travis Price, AIA, Sustainable and Modern are One and the Same

by Ronald O'Rourke

Green building standards can be integrated rather seamlessly into the design of a new home. Many DC-area homeowners, however, are increasingly likely to renovate and add onto an existing home. Is green design an option for them? Absolutely, according to local architect Travis Price, AIA, who argues that sustainable design can be incorporated into any project without compromising aesthetics, with little or no premium in construction cost, and with a substantial benefit in the form of significantly lower energy bills.

Price's firm, Travis Price Architects, recently completed two DC home renovation and addition projects that incorporate a number of sustainable design features. Julia Slavin and John Arnholz own a circa 1900, Tudor-style home with an original 2,600 square feet, located on a narrow, steeply sloped site overlooking Rock Creek Park in a neighborhood that Price describes as "shire-like." Price preserved the home's original exterior, renovated almost 90 percent of its interior, and added a modern, four-level, 3,200 square-foot addition on the back. The addition—a "vertical museum" that houses a library and display spaces for art and photos—fills the home with light and dramatically extends the interior into the forested landscape.



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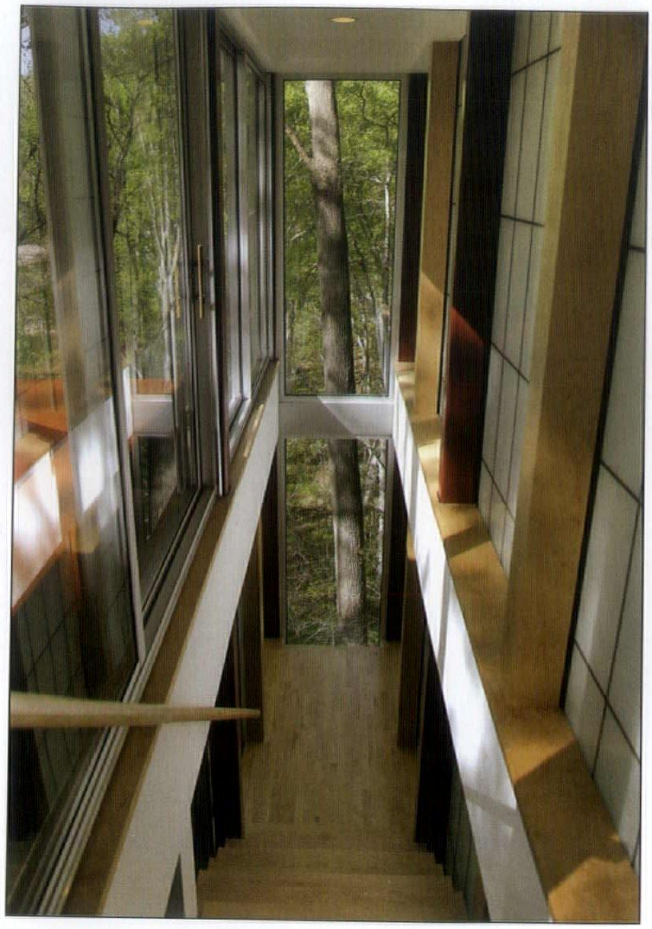

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Above and opposite: the Slavin-Arnholz Residence by Travis Price Architects.

"There's a tremendous amount of vertical tree action behind [the house]," Price said. "We celebrated verticality. [The property has] no yard, [so] we added an abundance of decks to compensate. The house is on a cliff and their kids wanted outdoor space where there is virtually none except wild park land."

According to Price, the addition creates "a powerful sense of movement toward the landscape. The moment you walk in the new space, it forces you to fly out the back. Nature is celebrated in full view. Every angle view is about trees vistas and light." The light-filled addition acts as "an eternal yet ephemeral lamp that serves as the intellectual and familial hub of the home."

Not far from the Slavin-Arnolz Residence, Price was asked by another client to renovate a circa 1950, 2,800 square-foot home in Chevy Chase Heights, a neighborhood with a mix of larger and smaller homes. The mid-century modern style of the existing house, Price said, "had great '50s modernist pizzazz." Price renovated about 65 percent of the existing interior and added 650 square feet of new space, in the process creating "a re-polished jewel in the rough—a very simple curved building [whose original style] we immediately labeled 'Early Safeway,' after that period of arched-roof grocery stores." The addition—a two-story glass cube that contains a "reading temple" on the second floor—stands in contrast to the home's original arched roof. Price likens the spirit of the completed design to "a Highway 61 pit stop."

In discussing the sustainable aspects of the two homes, Price noted that, "first and foremost, we saved the existing house—a significant sustainability feature in neighborhoods where tearing down rather than recycling older homes, and building new McMansions in their place, has become a common, and non-ecological, approach." Another sustainable design feature is the high degree of insulation. Both homes are insulated far in excess of standard practice: R-40 for the Slavin-Arnholz residence and R-30 for the Chevy Chase Heights home, compared to the more common R-19 in conventional home construction. (The "R" value of insulation is a measure of resistance to thermal transfer.) The sealed space in the double-pane windows of the two homes contains argon gas, which increases the thermal resistance to R-5, as opposed to R-1.2 for more conventional windows. The Slavin-Arnholz Residence also has a green roof, providing further insulation while helping to reduce the "urban heat island" effect and minimizing storm water runoff. Both homes are oriented for optimal sun-angle position and shading, and both make substantial use of sliding windows to maximize cross ventilation. Price estimates that as a result of these features, the homes will consume 50-70 percent less energy per square foot than homes built according to conventional building standards.

Energy conservation is among the most important sustainable design goals, but other environmental considerations also come into play. Both homes, for

Kenneth Wyner Photography

Kenneth Wyner Photography

Kenneth Wyner Photography

example, feature eco-cut hardwood flooring, milled from wood certified as having been harvested from select-cut rather than clear-cut forests. Rainwater coming off both houses is naturally filtered in gravel beds before entering the Rock Creek watershed, and all plants used for the landscaping are indigenous to Rock Creek Park. Exterior cladding materials such as copper and galvanized steel, though they are made of materials that must be mined and processed, can be considered sustainable building materials because of their durability and long life in relation to the environmental impact of producing them. "The use of metal skins," Price asserted, "is the most ecological choice over time."

Saving the existing building, using lots of insulation, maximizing cross-ventilation: all of these are fairly basic, low-tech design strategies, a point that Price likes to underscore. "There's no magic new technique or technology since 1960." Incorporating sustainability into the two projects, he said, posed very few technical or design challenges, because "90 percent of the real work is insulating, insolating [making best use of the sun's rays], shading, siting the project properly, installing good glazing, and picking responsible finishes. This is generally matter-of-fact and relatively boring stuff for architects, but key to good green basics."

Price estimated the added cost of using green building technologies on the two houses at 2-4 percent of construction cost, "if any at all." Considering typical DC-area residential utility bills for summer cooling and winter heating, even the high-end of this estimate could be recovered in a reasonably short period of time by a 50-70 percent reduction in energy use.

When asked which sustainable design attributes of the two homes gives him the most satisfaction, Price cited two: "The serenity and warmth of the indoor-outdoor experiences without sacrificing energy efficiency, and the warmth and beauty of modern materials and shapes that are visually pleasant in the landscape without sacrificing responsible landscapes elsewhere." For other DC-area homeowners who are contemplating home-building or renovation projects, Price hopes the design of these two homes demontrate that "green and modern [design] can be gracious, innovative, and responsible." Understanding this, he continued, "is the best portal into the world of green design, more so than how many BTUs or carcinogens are on the head of a pin."

"Green design is not simply the 'eco look' of wood, stone, [and so forth], but the more highly effective use of steel, glass, metal skins, and modern building materials that require less destruction of non-renewable resources, [generate] less pollution, and last for centuries. Thinking smart more than nostalgic was an attitude that opened [the clients'] awareness to the complexities of honest green design."

Left and inset: A renovated Chevy Chase Heights home by Travis Price Architects.

Costs & Benefits of Going Green

Debunking the Myth of the Sustainable Design Premium

by Adam Siegel

America has developed a 99-cent shopping obsession that has turned Benjamin Franklin's axiom "a penny saved is a penny earned" on its head. A price of $100 gives us pause, but a price of $99.99 seems like a bargain. Combined with easy access to revolving credit and our disposal culture, our focus on purchase price overshadows the *total* cost of many of our purchase decisions. We tend to focus on the "cost to buy" rather than the "cost to own." More often than we care to admit, we are—to trot out another axiom that predates Franklin—"penny wise and pound foolish."

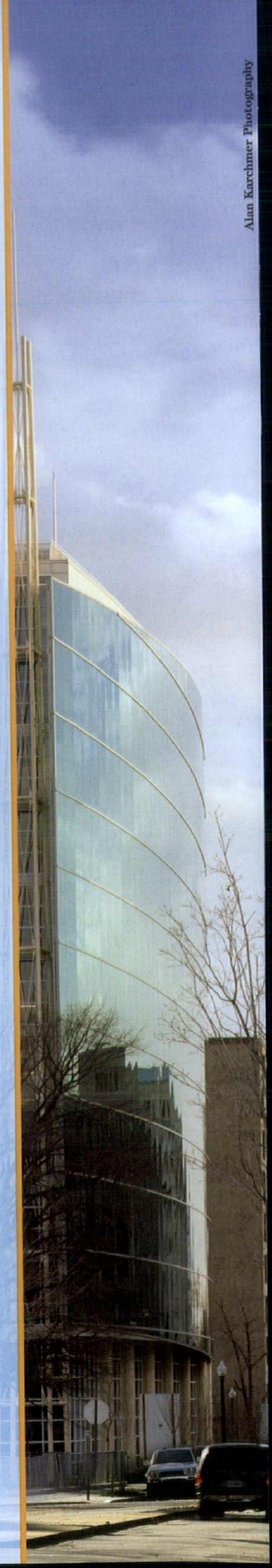
If sustainable design is to realize its full potential, we need to focus on the long-term. Reporting on the DC City Council's move to adopt the U.S. Green Building Council's (GBC) Leadership in Energy and Environmental Design (LEED) standards for all major buildings (beginning with District-owned buildings and expanding to include all buildings after 2012), *The Washington Post* informed its readers that "Opponents say building green can add as much as 11 percent to construction costs. Supporters place the extra costs at 2 to 4 percent but contend it's worthwhile." *The Post* left unchallenged whether building green actually adds to the cost of construction at all. Completely absent was any analysis of how building green might benefit the city or the buildings' owners and occupants.

Buildings designed to LEED standards do not necessarily cost more. Well-designed sustainable buildings can be heated and cooled with smaller mechanical systems and may require fewer light fixtures that are used less frequently, to name just two possible cost advantages. Smaller mechanical systems, in addition to being less expensive than larger ones, consume less energy and take up less space. Since most commercial buildings are built to the maximum allowable floor area, less space devoted to mechanical systems means more leasable space. The additional revenue can be attributed directly to sustainable design. Mechanical systems are also heavy. Smaller mechanical systems weigh less than larger ones, so structural engineers can design a lighter structure, significantly lowering the cost of construction.

Apart from any savings in the *cost to buy*, buildings built to LEED standards invariably *cost less to own*. They consume less energy for heating, cooling, and lighting, and typically use significantly less water by integrating waterless or low-flow toilets, flush-free urinals, and rainwater capture and storage systems for irrigation. They are built of materials and equipment that are more likely to last longer, requiring less maintenance and less frequent replacement. Light-emitting diode (LED) light fixtures, for example, can last decades while using only a fraction of the electricity of incandescent bulbs.

Sustainable buildings are often healthier buildings. Early studies have shown that workers in LEED buildings have lower absentee levels due to illness and higher productivity. And green roofs can help improve the health of the entire community, by reducing the volume of rainwater that enters the sewage system or that runs off into local streams and rivers. As sustainable design becomes more common, the benefits to the broader community continually increase. Entire city blocks of green or reflective roofs would help lower the outdoor air temperature—mitigating the "urban heat island effect"—and further lower the air conditioning load for ***all*** buildings in the neighborhood while improving outdoor comfort on hot summer days.

With the rise of real estate investment trusts, commercial buildings have become tradable commodities. As a result, fewer and fewer building owners are motivated by long-term incentives. The new DC Building Code requirement will help spur the private sector to adopt an infrastructure investment strategy that is best for building owners and for all of us.



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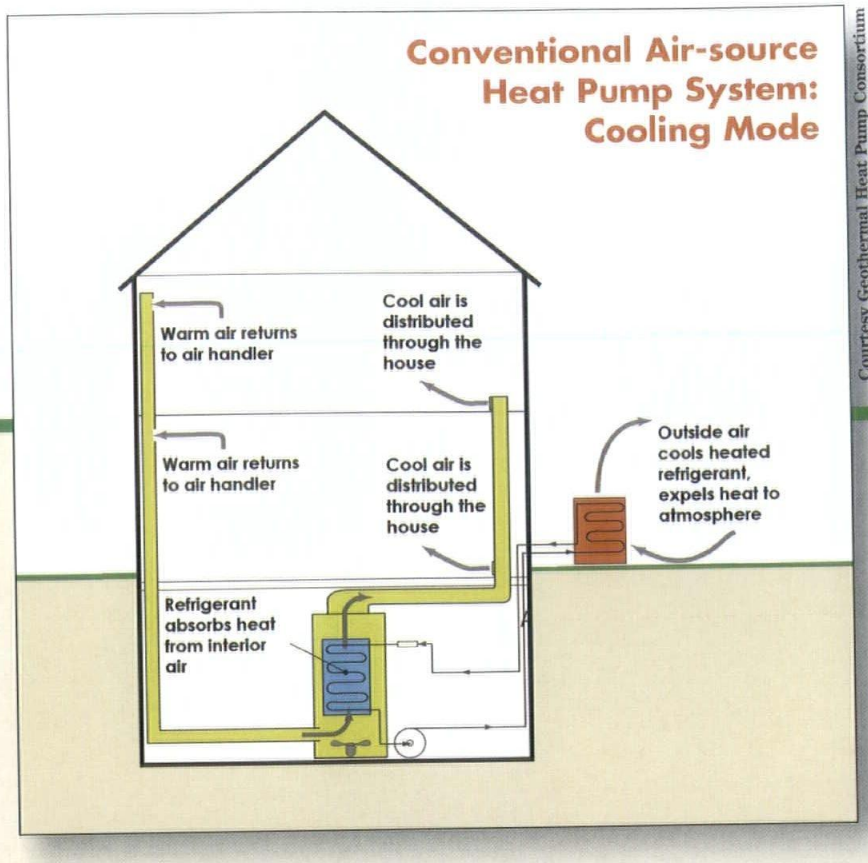


Courtesy Geothermal Heat Pump Consortium

In all three systems shown here, a compressor and a pressure reducer (decompressor) are located between the two heating/cooling coils, to moderate the differential pressure between the heat source and the heat sink.

From the Bosom of Mother Earth:

Heat and Cool Your Home with Geothermal Energy

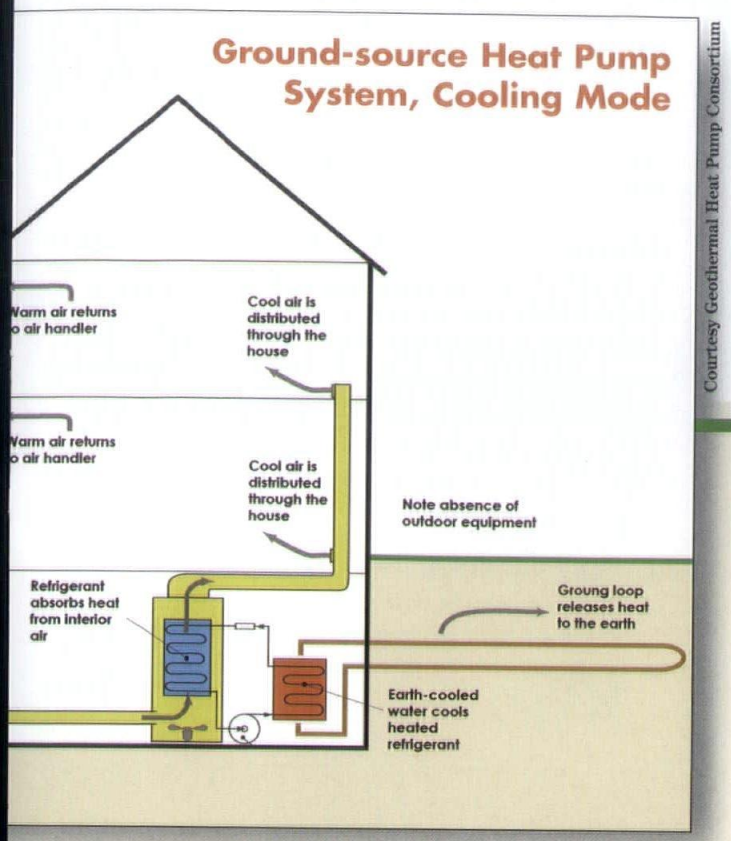
by Hal Bolton

Energy efficiency is a key element of sustainable design. Fortunately, there are a variety of ways to improve the efficiency of your home heating, ventilation, and air conditioning (HVAC) system, lower your utility bills, and reduce your consumption of fossil fuels. One option is to replace your existing HVAC system with a ground source heat pump (GSHP) system, sometimes called geothermal energy. But is a ground source heat pump the optimal solution for *your* home? Can the initial investment be recovered in reduced energy bills? Learning more can help you decide whether a GSHP system is right for you.

Fossil fuel heating systems generate heat by burning a fuel such as oil, gas, or wood, releasing the heat energy embodied in the fuel. A heat pump does not burn fuel; instead, electricity is used to operate a "pump" that extracts heat from a source and transfers it somewhere else: the interior of your home. Most heat pumps—up to 90 percent—are air-source heat pumps: They use the outdoor atmosphere as the source of heat energy.

How Does a Heat Pump Work?

How is it possible to use cold outside air in winter to heat your home? Well, even very cold outdoor air contains *some* heat. (After all, if there were no heat at all, the outdoor temperature would be absolute zero, or minus 460 degrees Fahrenheit.) Heat pumps can extract even low levels of heat from a large volume of air by compressing it, effectively wringing the available heat out of a given volume of air. For example, let's say that at on a given winter day, the outdoor air is so cold that it contains only one BTU (British Thermal Unit) of heat energy per cubic foot of air. If the heat energy in every 1,000 cubic feet of air is compressed into a single cubic foot,



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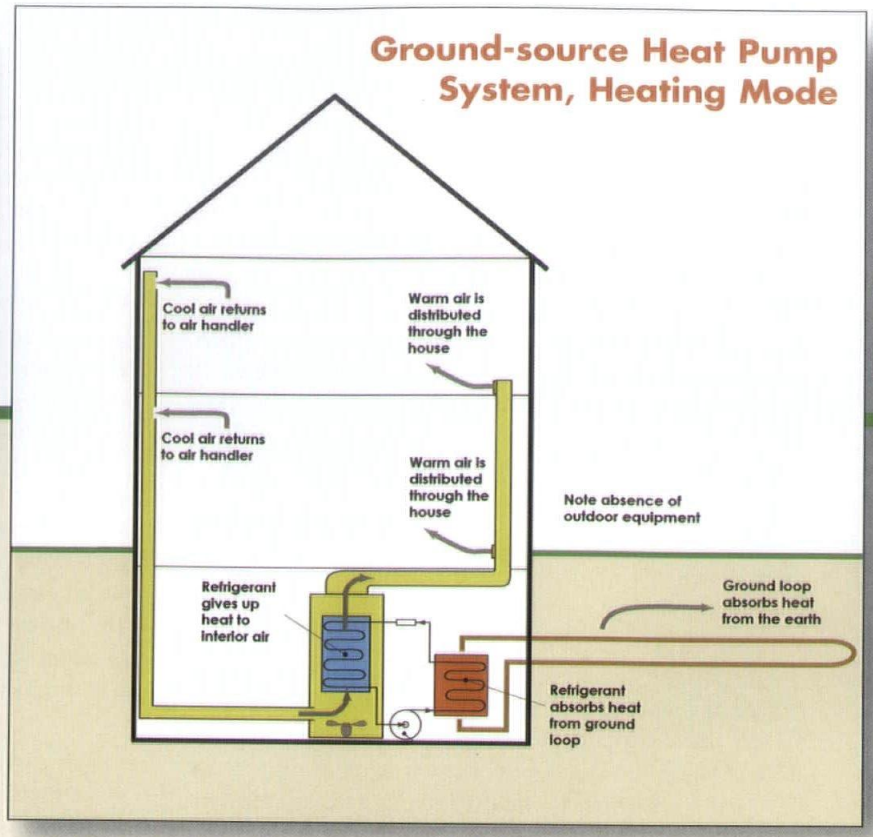

Courtesy Geothermal Heat Pump Consortium

you would now have 1,000 BTUs per cubic foot—a lot of heat! To work effectively, heat pumps depend on the differential volume of the heat source (the outside air) and the heat sink (in winter, the interior of your home).

Of course, as the outdoor air temperature drops, heat energy needs to be compressed from more and more air, and the pump has to work harder, consuming more electrical energy in the process. At some point, the heat pump system becomes so inefficient that it is more expensive than simply burning fossil fuel. Below 30 degrees Fahrenheit, most air-source heat pumps must rely on an auxiliary source of heat, such as electric resistance heat, the same type of electric heater that you can buy at any hardware store. Electric resistance heaters are extremely inefficient. For this reason, air-source heat pumps are most effective in milder climates, where winter temperatures rarely drop below 40 degrees.

A very useful aspect of heat pump technology is that heat pumps can be used to both heat and cool a building, simply by reversing the direction of heat transfer. In the winter, the outdoor air is the heat source, while the interior of your home is the heat sink—the place where the heat is deposited. In the summer, the interior of your home is the heat source—the place from which heat is extracted, and the outdoor air is the heat sink. Air-source heat pumps are actually more efficient in cooling mode than in heating mode, because less energy is needed to extract heat from the relatively small volume of air in your home in the summer than is needed to extract heat from a large volume of cold outdoor winter air. Still, air-source heat pumps consume a lot of electrical energy.

Drawing Energy From the Earth

Ground-source heat pumps, as their name suggests, use the ground—instead of air—as the heat source in winter and as the heat sink in summer, taking advantage of the constant temperature of subsurface soil or water. The ground temperature just a few feet below the surface remains constant year round—in the mid-Atlantic region, about 55 degrees Fahrenheit. The constant ground temperature greatly improves the efficiency of ground-source heat pumps, which can produce far more heat per unit of electricity than air-source heat pumps. GSHP systems are also far more efficient for cooling in summer, because they use cool ground instead of warm outdoor air as the heat sink.

There are two types of ground-source heat pumps: closed loop and open loop. Closed loop systems, which rely on copper or high-density polyethylene pipe buried in the earth, are the most common. The pipe is buried either vertically in wells 100 to 400 feet deep, or horizontally in trenches four to six feet deep. A water-based solution—environmentally friendly antifreeze or (in some cases) refrigerant fluid—circulates through the pipes, extracting heat from the earth in the winter and dumping heat into the earth in the summer. Horizontal systems, because they do not require drilling, tend to be less expensive but require a larger tract of open, lightly vegetated land. They are typically used for smaller installations unless abundant, inexpensive land is available.

Horizontal systems rely on the sun's warmth to maintain the constant ground temperature. Vertical systems

are the only true "geothermal" systems, reaching levels deep enough to rely on geothermal heat—the heat emanating from deep within the earth. GSHP systems work best in climates where heating and cooling seasons are roughly equal in length—such as our own mid-Atlantic region—so that the soil temperature is not overly affected—or "charged"—by too much heating or cooling. Over time, unbalanced heating and cooling loads can reduce the efficiency of the system by reducing the capacity of the soil to extract or provide heat.

Open loop systems use an open body of water, such as a lake or pond, as the heat source/heat sink. The water circulates through a heat exchanger and is either returned to the original source or discharged. Open loop systems can be more efficient than closed loop systems but have the obvious requirement of a nearby body of water, and the added maintenance requirement of protecting the intake from clogging due to sediment.

Pros and Cons: The "Plus" Column

The many benefits of ground-source heat pumps include low energy consumption, minimal environmental impact, and long-term durability. GSHPs are far more efficient (consume less energy) than most other systems—electric resistance heat, fossil fuel (oil or gas) combustion, or air-source heat pumps. GSHPs require less space than traditional mechanical systems, liberating valuable space as useable living space. When retrofitted to existing homes, a GSHP system can typically use existing ductwork, eliminating the need for extensive retrofitting of finished spaces. Because a GSHP does not burn fossil fuels, on-site combustion is eliminated along with concerns about proper ventilation and isolation of fresh air from combustion air. No combustion means no flue or chimney, freeing more indoor floor space and eliminating a penetration in the roof through which heat can escape and water can enter.

Eliminating combustion also reduces the volume of greenhouse gas emissions compared to other mechanical systems. The electricity to operate the GSHP may be produced by burning fossil fuels, of course, but even this can be eliminated or reduced if the electric energy is generated from renewable energy sources. While it may be difficult to generate enough electricity to take your home completely "off the grid," it is possible to generate most, if not all, of the electricity needed to operate your GSHP system from photovoltaic (PV) solar cells or wind-powered systems, with the power grid as a backup. In many places, homeowners also can contract with their utility company to purchase "green power," which is produced only from renewable sources.

GSHP systems typically generate more heat energy than is needed. A "desuperheater," a mechanical coil attached to the compressor, can transfer that excess heat to your hot water heater, essentially providing free hot water in the summer and in winter cutting the cost of domestic hot water in half.

Durability and low maintenance costs are other factors in favor of GSHP systems. Most GSHP piping is sold with warranties of up to 50 years. Nearly all moving parts are indoors, unlike air-source heat pumps in which a fan-coil unit—half of the system—must be outdoors, fully exposed to the elements. GSHP systems are also quieter, because the large, noisy outdoor unit is eliminated.

Pros and Cons: The "Minus" Column

GSHPs do have a few drawbacks. They are not very effective in very cold climates—they work best in climates with balanced heating and cooling loads. So a GSHP system might be a good option for your DC-area home, but not such a good choice for your vacation home in Vermont. And if you are building a new home, in the long run it may be more cost effective to "super insulate" your home and incorporate passive solar features such as sun shades to reduce the heating/cooling load. The size of any HVAC system is determined by the amount of heating and cooling needed to maintain comfort. If the heating/cooling load is substantially reduced, the size (and cost) of ***any*** heating/cooling system can be smaller. It might be cheaper and more energy efficient to install a high-efficiency vented gas heater, or even electric-resistance heat (especially if combined with PV cells to generate the needed power).

A PERFECT FIT FOR RETROFIT

OPERATING ESTIMATE / COST COMPARISON

RESIDENCE: Oklahoma City, OK
COMPLETED: 1996
TOTAL AREA: 2,300 sq. ft.
OLD SYSTEM: Gas fired heat, electric air conditioning
NEW SYSTEM: Geoexchange

HVAC Systems	Annual Heating	Annual Cooling	Annual Hot Water	Total Cost
Propane furnace, electric AC	$1,443	$507	$476	$2,426
Gas furnace, electric AC	653	507	228	1,388
Air source heat pump	380	419	476	1,275
Geoexchange	189	258	228	675

Data provided by ClimateMaster, Oklahoma City, OK.

Courtesy Geothermal Heat Pump Consortium

A NEW CONSTRUCTION SOLUTION

OPERATING ESTIMATE / COST COMPARISON

RESIDENCE: St. George, Utah
TOTAL AREA: 3,067 sq. ft.

HVAC Systems	Annual Heating	Annual Cooling	Annual Hot Water	Total Cost
Propane furnace/electric AC	$839	$592	$337	$1,768
Gas furnace/electric AC	314	592	122	1,028
Air source heat pump	218	592	183	993
Geoexchange system	64	166	98	328

Rates based on electricity @ $.046/kwh, natural gas @ $.055/therm and propane @ $1.40/gallon.

Courtesy Geothermal Heat Pump Consortium

All heat pumps, including GSHPs, use refrigerant as a heat transfer medium, which are potentially harmful to the environment. GSHPs typically use R-22, a hydrochlorofluorocarbon (HCFC), which is less harmful to the ozone layer than CFCs, but is still harmful if released into the atmosphere. Any heat pump system, including GSHP, must be maintained properly to ensure that refrigerant leaks do not develop. On the plus side, GSHPs typically use half as much refrigerant as air-source heat pumps, and the buried pipes help protect the refrigerant.

Drilling or trenching for GSHP piping can create a certain amount of site disturbance, more so for horizontal systems that may require several hundred feet of trenches dug four to six feet deep. This can be a concern in fragile or heavily-forested surface environments. Vertical systems use anywhere from two to a dozen (or more) small wells, typically four to six inches in diameter. There is relatively little disturbance at the surface, but groundwater contamination is a potential concern. Piping systems must be installed in accordance with state and federal regulations for drilling and sealing the wells to help ensure that contamination does not occur.

Pros and Cons: The Bottom Line

GSHPs typically cost more to install than conventional mechanical systems, mostly due to the cost of drilling wells. Rebates (from your power company) or tax credits may be available to help offset these costs. Experienced installers and drillers also may help reduce costs. Local soils conditions can affect the size of the loop that must be used and the number of wells needed. It is really important that the system be designed and correctly sized by a qualified engineer. The backup system (typically electric resistant heat) for an undersized GSHP can wipe out any cost savings of the system, while a properly sized system will help control humidity levels, an important consideration in the DC area. Properly designed and installed, the cost of a GSHP system can be recovered in reduced energy costs in as little as three to five years. You consume less energy from the first day of operation, and after the initial payback period, the cost savings are also permanent.

Further Reading

A wealth of additional information is available from the Geothermal Heat Pump Consortium. Visit the consortium's Web site at **www.geoexchange.org.**

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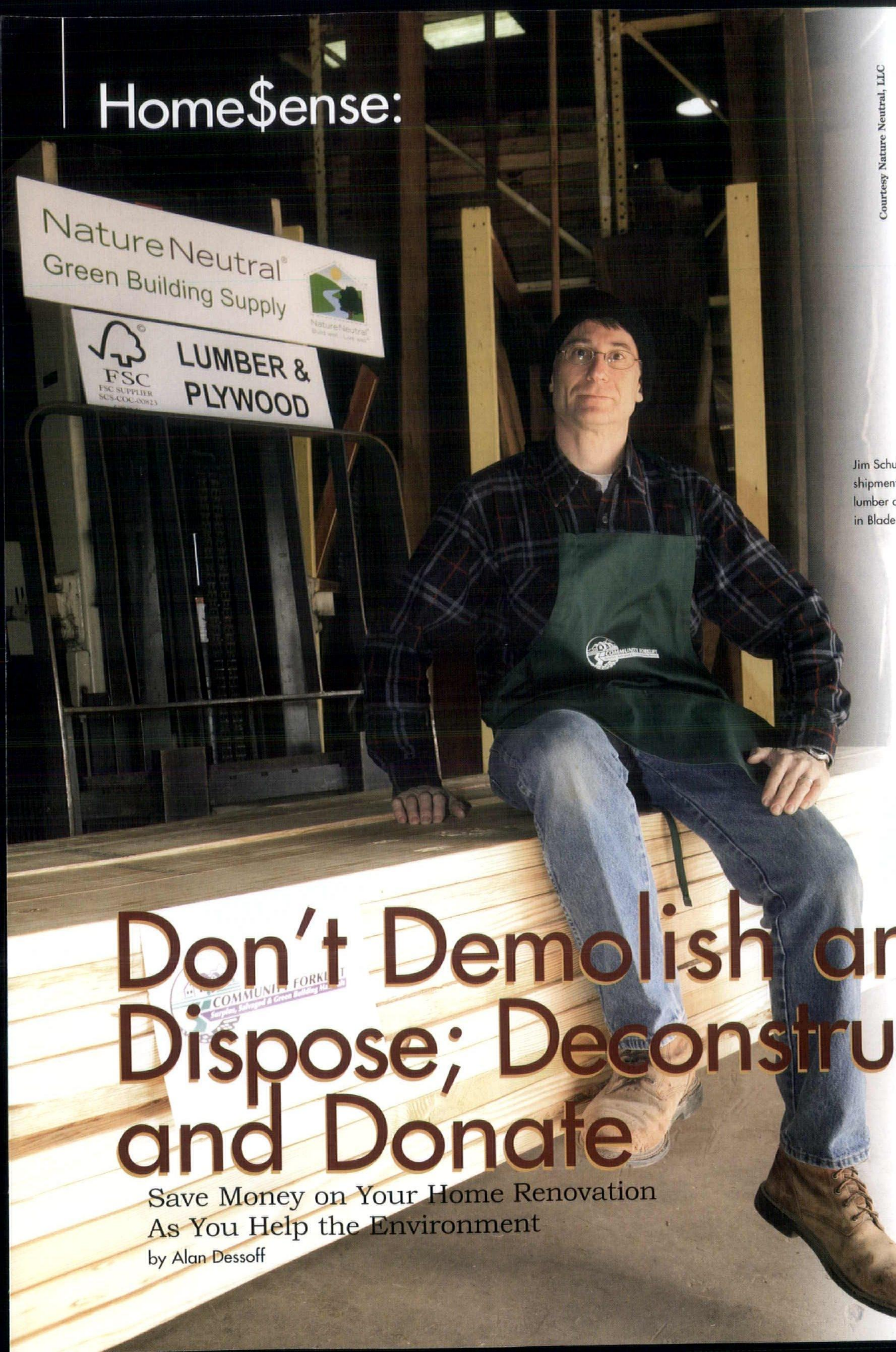

Courtesy Nature Neutral, LLC

Jim Schulman, AIA, receives a shipment of sustainably-forested lumber at Community Forklift in Bladensburg, Maryland.

Don't Demolish and Dispose; Deconstruct and Donate

Save Money on Your Home Renovation As You Help the Environment

by Alan Dessoff

To the casual visitor, it probably looks like a junkyard, a flea market, or a primitive version of the massive emporiums that sell home remodeling and building supplies today. But to architects, builders, and homeowners who know better, Community Forklift is a treasure trove.

"You could build an entire house from what's in this place," said Tim Lyons, principal of Lyons & Associates, a residential design firm in Takoma Park, Maryland. On a cold January afternoon, he was among a handful of customers poking around the place—an unheated 34,000 square foot warehouse in an industrial area just north of Bladensburg, Maryland, about a mile from the DC line.

He might be right. Just about everything one might need to put a house together can be found at Community Forklift, one of the more unusual retails stores in the DC area. Most of it came from houses in the first place—doors, windows, lumber, masonry, plumbing and electrical fixtures, lighting, and hardware. There are radiators, flooring, cabinets, washers and dryers, wallpaper, decking, countertops, granite, tubs and toilets, and just about everything else it takes to build a house—and then some.

Need a spiral staircase? Porch columns? Iron gates? A Jacuzzi tub? That's just part of the "cool stuff," as Jim Schulman, AIA, describes it, that shoppers might find on any given day. It's all for sale, at prices up to 80 percent off retail value. Schulman, who founded the nonprofit business, calls himself a "recovering architect" because he no longer has time to practice his profession these days. "This business is all-consuming," he said in his cluttered office above the warehouse.

Saving Treasure From the Trash

Schulman's business plan for Community Forklift is built on the premise that one person's trash is another person's treasure. A key element of sustainable design and construction is to rescue the "trash" so it can become a treasure again. In the process, the useful life of perfectly serviceable materials and products is greatly extended, less trash is dumped into landfills, and the energy and raw materials needed to create new products and materials is eliminated. When you buy from Community Forklift for your home renovation or new construction project, you score a sustainable design "hat trick" before you even begin.

The building materials found at Community Forklift are salvaged mostly from homes, and some commercial properties, that are "deconstructed" instead of being demolished. About half the inventory in the store is salvaged this way, said Schulman, who cites firms such as Deconstruction Services, Inc., in Fairfax, Virginia, that take buildings apart carefully, for a fee. The property owners then donate the materials to Community Forklift, a 501(c)(3) nonprofit entity, and take a tax deduction for it. "If you subtract the tax deduction from the fee you paid for the deconstruction, it's competitive with the cost of [conventional] demolition, and maybe less," said Schulman, "and you don't have to pay dumping fees."

Most of the other items that come into the warehouse also are donated, some by construction contractors and suppliers and some by homeowners cleaning out their attics, basements and garages. "Instead of keeping the stuff and waiting 10 years to figure out whether you will use it or not, you can bring it here, get a tax break, and make space in your garage," Schulman says. "We'll find somebody who needs it and is willing to pay for it and get a super deal, maybe less than half of what they would pay at Home Depot."

In addition to salvaged items, Community Forklift is beginning to sell environmentally friendly "green" materials such as sustainable bamboo flooring, paints and sealants low in volatile organic compounds (VOCs), and cotton insulation.

Sustainability as a Business Model

Though it operates as a retail store open to the public, Community Forklift's mission runs much deeper. Opened in November 2005 by Sustainable Community Initiatives (SCI), a nonprofit organization that Schulman also founded, it seeks to foster community revitalization by making building materials and repairs more affordable for homeowners, small businesses and community groups; reduce construction industry waste; promote environmentally-friendly building materials and methods; and create construction or deconstruction jobs for nearby low-income residents.

More than 50 other North American cities and towns have stores that sell used building materials, many of them run by Habitat for Humanity chapters under the "ReStore" name. In the Habitat model, profits are channeled toward the construction of new affordable housing. For Community Forklift, the relationship between sales and affordable housing is more direct: by making available a high volume of affordable building materials in the economically disadvantaged area where the store is located, the organization hopes to spur the direct revitalization of local neighborhoods.

Schulman, who grew up in the Midwest, came to the Washington area in 1985. Fresh out of the University of Minnesota's architecture school, he was fascinated at the time by adobe architecture and was looking for work in the Southwest until a Washington firm called and offered him a job. "It was another 15 years before I got to see the Southwest," he said.

In Washington, he gained "a smattering of experience" in residential, commercial, and institutional architecture with several small firms but became frustrated because he "couldn't find many people interested in pushing the envelope on environmental sensitivity in construction." That led him to start SCI and then Community Forklift. "I haven't abandoned architecture completely, but it's a side path to what I do now," he said. "A lot of architects are our customers and I think my background is sometimes helpful in communicating with them."

Finding The Pearl in the Oyster

Schulman ran into Tim Lyons on the warehouse floor in January. Lyons, who is not a registered architect but has associates who are, was poking around the "Table of Luck," so identified by a sign that Schulman posted because "you never know what you're going to find here." Schulman selected from the table an old video case that contained a four-inch wallpaper scraper and blades. "It's perfectly good," he commented. The price was $4.

Lyons, whose firm specializes in residential projects, was looking at doorknobs. He has been to Community Forklift at least two dozen times and has found many useful materials for clients as well as for his own house.

"I've gotten some lumber for a deck here. I bought a bunch of columns and found some crown moldings for a lot less than what you would have to pay for them somewhere else if you were even able to find them," he said. "I've been to other salvage places. This probably has the most practical stuff and is a lot more reasonable."

According to Schulman, an architecture firm found pieces of glass from former jalousie windows that were perfect for a client's office layout. "They came up with a design that involved little slots of glass to bring light into the offices behind curving sheetrock walls," he said.

Schulman recognizes that Community Forklift's inventory is better suited to renovation and repair jobs than to new construction. "We don't have the volume of materials for that," he said. But many of the products are unusual, hard-to-find artifacts that can add a distinctive design element to the most modest renovation project. They include a huge wooden fireplace mantel salvaged from the home of a former cabinet secretary after a fire, and a set of curved windows from the home of a founder of a prominent local business. Some items, like crystal door knobs, qualify as antiques.

Packaged in two cartons in an outside yard is an 80-year-old, 1,100 square-foot log cabin, complete with instructions for reassembly. Schulman said it was "lovingly deconstructed" and removed from a property in McLean, Virginia, to make way for construction of a "McMansion."

"We have made some mistakes," said Schulman. "I don't have a retail background, and running a store is not for the faint of heart. Coming up with a price is kind of an art. A lot of it is off the cuff. Our bias is to just give somebody a deal." There is a 14-day return policy but Schulman said returns have been few, "five or ten out of the hundreds we have sold." He never knows what might come in or go out on any given day. He cites beech hardwood flooring from an abandoned local public housing project that he sold, sight unseen, to a shopping center builder in Ohio. "They wanted it to look like an old factory, so they wanted wood boards that looked rough, with paint on them. We sold that flooring without having to strip off the paint or mill it or anything."

"Sometimes we'll get really nice things," he continued, like a new water heater, still in its box, or a leaded glass chandelier. "That stuff is not part of our mission, but it sells quickly and helps to pay the bills." He also never knows who his customers will be. Many are small contractors, and he would like to see more of them, as well as architects, designers, and crafts people. In Community Forklift's first week, one customer was a laborer who walked away carrying four wood studs on his shoulder. The next customer was the chief of staff for a U.S. Senator, who bought a load of bricks for her garden. "There are some people who will never want something that's been used," said Schulman. "It's not in their nature." Community Forklift is for shoppers with a different outlook, bent on finding bargains that are kind to the planet.

Courtesy Nature Neutral, LLC

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-Bruce Mau and the Institute without Boundaries

design DC 2007

Massive Change Ahead

Bruce Mau's Massive Change Project is not about the world of design; it's about the design of the world.

by Mary Fitch

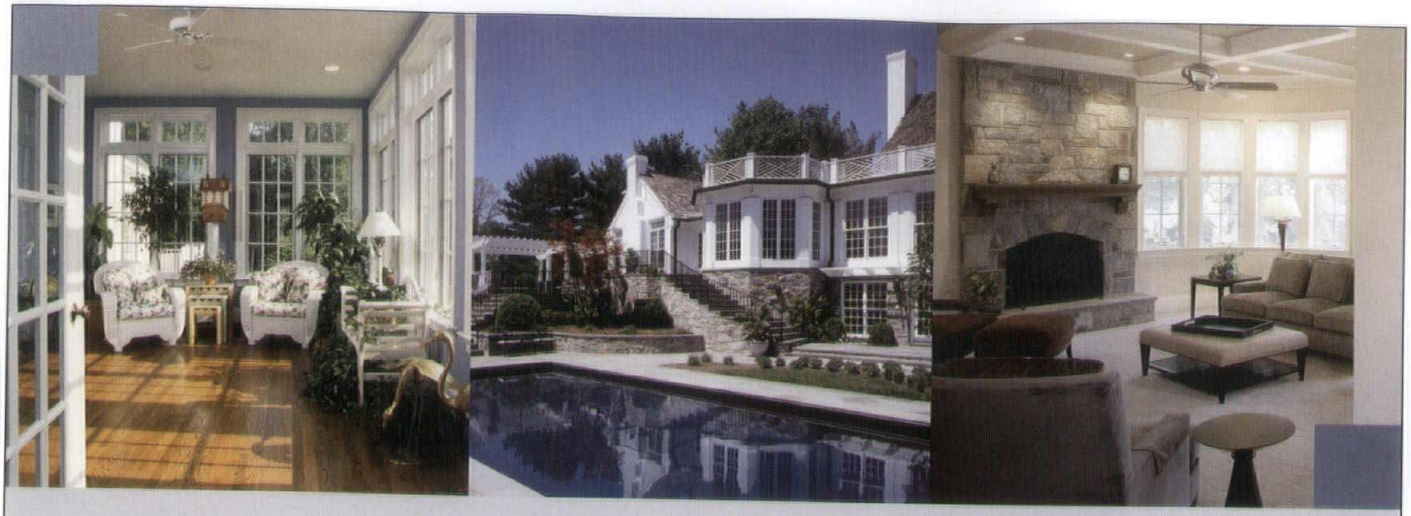
AIA | DC and **AIA Potomac Valley** are proud to open **DesignDC 2007**, their third annual building industry conference and tradeshow, to be held at the **Ronald Reagan Building and International Trade Center,** with a public keynote address by environmental designer **Bruce Mau** on **Wednesday, July 18 at 5:30 p.m.** Founder of Toronto-based **Bruce Mau Design,** Mau's view of design transcends the design of individual objects to encompass systems—transportation systems, public health systems, the global economy.

Massive Change: The Future of Global Design was the inaugural project of the **Institute without Boundaries,** a twelve-month interdisciplinary postgraduate program offered by Bruce Mau Design in partnership with the **School of Design at George Brown Toronto City College,** Toronto, Canada. The goal of the program is to cultivate a new breed of designer, one who is, in the words of Buckminster Fuller, "a synthesis of artist, inventor, mechanic, objective economist, and evolutionary strategist."

Commissioned and organized by the **Vancouver Art Gallery,** the project took the form of an exhibition that invites viewers to consider the dynamic future of design culture and the crucial real-life choices we must make. Dramatic, engaging and critical, *Massive Change* unfolds in a series of eleven general themes that address the fundamental role of design in all aspects of human life, from manufacturing and transportation to health and the military. In each area, visitors encounter the objects, images, ideas, and people that are reshaping the role of design in the world.

Massive Change has since taken on the form of a book, a radio forum, an online forum and blog, and a series of formal and informal public events that now includes DesignDC 2007. The project underscores the role of design in everything we experience in our environment, whether the underlying cause is tangible or intangible. The width of sidewalks, where trees are planted, how property law works—all that was designed by someone, all effect how we experience the world. By recognizing the role of design in all aspects of human endeavor, and transcending the conventional boundaries of professional, scientific, and design disciplines, Mau offers an array of innovative and practical approaches for changing how we live and for correcting the ills of our planet.

Anyone with an interest in design and the future of our environment will find Mau's DesignDC lecture both inspiring and stimulating. To join us on **July 18, 2007, at 5:30 p.m.,** register online now at **www.aiadesigndc.org.**



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